ENVIRONMENTAL HEALTH EDUCATION IN UNDERSERVED HISPANIC COMMUNITIES

A Dissertation

by

JENNIFER ANN ROSS

Submitted to the Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

DOCTOR OF PUBLIC HEALTH

Chair of Committee,	Leslie H. Cizmas
Committee Members,	Thomas J. McDonald
	Eva M. Shipp
	Luohua Jiang
Head of Department,	Thomas J. McDonald

December 2013

Major Subject: Epidemiology and Environmental Health

ABSTRACT

The focus of this study was to use environmental health education to improve topic-specific health literacy in two underserved Hispanic communities, Webb County and San Antonio. Hispanic communities may have disparities in income, health care, pesticide use, and access to health information when compared to non-Hispanic communities. The education intervention topics, pesticides and nutrition, were topics of relevance to participants in these communities. *Promotoras* delivered the health education interventions and assessments. Assessments of knowledge, attitudes, and behaviors were given to participants prior to, immediately after, and several months after the health education intervention. These repeated measures assessed change and persistence of change following the message. Paired t-tests, McNemar's chi square, and Wilcoxon sign rank test were used to assess significance of change in the repeated measures. Between-community differences were assessed with Wilcoxon rank sum tests. One community, San Antonio, was in an urban setting, while the other community in Webb County was functionally rural despite the location near Laredo. The demographics of the participants from the two study communities were very similar in gender, country of origin, education status, employment status of self and spouse, and language. Participants in the two study communities reported similar pests, household pesticide use, continuing pest problems, planned household pesticide use, and past use of illegal pesticides. In Webb County, the mean summed pesticide knowledge pre-test score was 13.68 (98.33% CI: 13.24, 14.13). The summed knowledge scores for the knowledge

assessment after the module were 15.92 (98.33% CI: 15.58, 16.25) in Webb County and 15.36 (98.33% CI: 14.90, 15.82) in San Antonio. There were also statistically significant changes in some attitudes and behaviors regarding pesticides in both communities; however, the communities had different baseline attitudes and behaviors. For the nutrition intervention in San Antonio there was an increase of 0.92 (98.33% CI: 0.28, 1.56) points between the pre-test and immediate post-test, an almost 10% increase in the mean participant score following the module. Between the pre-test and three month post-test, there was a 0.54 (98.33%CI: -0.21, 1.28) point increase in mean knowledge score on the three month post-test when compared to the pre-test. The results suggest that pesticide health education can change attitudes and behaviors regarding pesticides. The nutrition module resulted in significant immediate changes in knowledge, but not in the long-term. However, there were long-term changes in some attitudes and behaviors following the nutrition module. Additionally, the Webb County pesticide intervention results suggest that even with linguistically and culturally appropriate promotora driven interventions, evaluation and education modules should be developed taking into account the baseline knowledge, attitudes, and behaviors of the community.

DEDICATION

This dissertation is dedicated to my husband Scott Robinson. He encouraged me to return to school, and supported me every step of the way.

ACKNOWLEDGEMENTS

My committee has been very generous with their time and support. First and foremost, I would like to thank my advisor Dr. Leslie Cizmas for her support, mentorship, and guidance throughout my graduate career. My sincere gratitude goes to committee member, employer, and department chair, Dr. Tommy McDonald, for his guidance, many roles, and introduction to Dr. Cizmas. I would also like to thank Dr. Eva Shipp for her support, letting me work on some of her projects, and vetting my ideas throughout this process. Finally, I thank Dr. Louhua Jiang for her patience with my questions, excellent answers, and guidance.

Many people have been involved with the project that produced this work, and I wish to express my appreciation for their work. Rudy Rincon and Roger Perales oversaw much of the work in Webb County and assisted in translations. Dr. K.C. Donnelly wrote the first version of the Home Safety module used in this project. The STEER *promotoras,* Hermalinda (Melly) Tamez and Aurora Ginez, played many roles in this work. The San Antonito *promotoras*, Leila Muzquiz, Misty Hernandez, Xochitl Espinoza, Consuelo Trevino, and Sandra Sandoval along with former Family Service Association (FSA) Community Liaison Ron Morales assisted in development of the Nutrition module. Leila Muzquiz led the other San Antonio *promotoras* in the many roles they played in this project. Kyle Cunningham of the San Antonio Metropolitan Health District linked us to FSA. Graciella Castillo and Dr. Larry Gamm developed the original knowledge and demographic Home Safety assessments. Dr. Jessilynn Taylor of

ATSDR was our grant officer and provided multiple opportunities to discuss our research.

Many other faculty and staff members have significantly influenced me. Dr. Quiram was the first person with whom I met from SRPH; she and a short conversation with Dr. Gorman convinced me to apply to SRPH. Dr. Rene convinced me to apply to the doctoral program and has been supportive throughout the program. Dr. Zhou and Dr. Huber taught me to see statistics in different ways. Dr. Gorman and Dr. McLeroy inspired a renewed interest in the philosophy of science and social network studies. I hope to complete my agent based modeling project that I would have never begun without Dr. Zheng. From Dr. Brender and Dr. Sweeney, I learned about challenges in studying children, infants, and pregnant women. Dr. Benden and Dr. Pickens are persuasive enough to make me occasionally forget why I do not want to be an engineer. Ms. Bokelmann has been encouraging, informative, and I am indebted to her for her insight. Devy Hardeman has already answered so many questions about the dissertation process. A million thanks to Britta Wright for her support, assistance, and friendship.

Many of my fellow graduate students, have listened to my presentations, read my papers, looked over my posters, and provided assistance. My officemates Amber Trueblood and Kristen Miller have been exceptionally kind by listening to my rants, proofreading many documents, and offering friendship and support. Chris Pase, Sonya Shannon, Ann Vuong, and Mayura Shinde made our many classes together more impactful through discussion and feedback. Heather Reddick, Meghan Kress, Heather

Clark, Cara Pennel, Marc Adams, and Chidiebere Opara have been a supportive and understanding group.

I have been blessed with caring family and friends who supported me in so many ways. Roger Hagedorn, Rachel Short, Brian and Alynda Long, and Shari Heftel, are dear friends who have been particularly supportive. I wish to express deep gratitude to my parents, John and Ann Ross, and my in-laws, Chris and Barbara Robinson. Finally, I express my heartfelt gratitude to my husband.

Funding Sources: This work was funded under CDC/ATSDR Cooperative Agreement # 1UO1TS000107-01(revised).

TABLE OF CONTENTS

Page

Page

LIST OF TABLES

LIST OF FIGURES

1. INTRODUCTION

1.1. Health Literacy

Health literacy has many definitions and these definitions have evolved since the term was introduced in the 1970s (1). A brief definition of health literacy is the ability to collect, comprehend, and utilize health information, and obtain health services to make informed health decisions (2). According to the Institute of Medicine (IOM), achieving health literacy requires involvement of the healthcare system, culture, and the education system (3). Low health literacy is correlated with increased need for health care, increased health care-related costs, increased hospitalizations, less use of preventative health services and inferior health outcomes (4, 5). Further, low health literacy is linked to health disparities in the U.S. (1). Health literacy has an influence on health behaviors, attitudes, and use of health care services. Increased health literacy leads to better health outcomes through gained knowledge, increased self-efficacy, and improved health behaviors (6). People with enhanced health literacy may become more autonomous and empowered, thereby improving their quality of life (1).

Education level and general literacy affect health literacy. General illiteracy is the lack of ability to read or write. Less than 5% of people in the U.S. are illiterate (7). One is considered functionally illiterate if one reads and writes below the fifth grade level (7). Functional illiteracy makes one unable to understand, interpret or apply words correctly. Marginally illiterate individuals read and write at the eighth grade level or lower (7). Those with marginal illiteracy have difficulty functioning in U.S. society.

Approximately 44 million individuals in the U.S. are marginally illiterate (7). Due to stigmatization and shame, many people report having a higher literacy level than their actual ability, further entrenching low health literacy (4).

Illiteracy leads to low health literacy. An IOM report stated that nearly half of adults in the U.S. have some level of low health literacy (8). The average person in the U.S. reads at the seventh grade level (9). Many printed health materials such as, prescriptions, pamphlets, consent forms, and patient instructions, are written at or above eighth grade reading level (8). People with low literacy may also have low numeracy, increasing the difficulty of communicating risk (10). Medical and scientific terminologies are also problems for non-English speakers, as these terms are more difficult to understand. Thus problems with medical compliance may be due to lack of comprehension of instructions given to the patient. Often, those with lower literacy have more medical need (9). Low health literacy can lead to poor health outcomes from lack of comprehension of medical information.

One factor that contributes to health disparities due to low health literacy is the way in which written health information is prepared. In the 2003 National Assessment of Adult Literacy, 43% of all Americans are unable to reliably and correctly use printed information on finances, health, and safety (11). While over 10 percent of all Americans are marginally illiterate, reading at a fifth to eighth grade level, over 50 percent of minority Americans are marginally illiterate (12). According to the 2000 Census, eight million of the 17 million Spanish speaking residences were linguistically isolated (13). Linguistically isolated homes are those in which no resident over the age of 14 speaks

English at least "very well" (14). Spanish is the primary language of 64% of Hispanics born in the U.S. (13). Many existing materials available in Spanish are direct translations of the English version (15, 16). These direct translations may not be culturally or linguistically appropriate to the target audience. Additionally these materials may exceed the reading level of the audience. The same factors that can cause a person not to follow medical instructions may interfere with his ability to follow pesticide instructions, safety guidelines on home appliances, and nutrition information. It is important to consider culture and literacy as well as the language when developing an intervention.

1.2. Health Education

According to Sorensen, health literacy can be expressed in four dimensions and three domains (1). The dimensions are health information access, comprehension of health information, processing the health information, and utilizing the health information (1). The three domains are health care, disease prevention, and health promotion (1). Health literacy, health promotion, and health education are sometimes used interchangeably, but that is incorrect. Health promotion is a broader term than health education, in which health education, community development, environmental safeguards, organizational services, and regulatory undertakings may all be utilized to improve health (2). Health education is a more specific term, referring to learning activities that may cause voluntary changes in behavior leading to improved health outcomes (2, 17). Health education may occur through a personal mentor-mentee

relationship, or may use mass media to reach a broad audience (2). According to Israel and colleagues, "the prevailing emphasis in health education is on understanding and changing lifestyle choices and individual health behaviors related to health status" (18). Health education is a method to improve health literacy.

One concern with health education, is a tendency to try to teach individuals about a problem with little effort directed towards eliminating the problem's source (18). This may place blame on the individual, who is often a victim of circumstance. Health education interventions need to give information to participants in a non-judgmental fashion. Additionally these interventions must provide reasonable alternatives. One way to ameliorate this concern and concerns about language is to employ community health workers or *promotoras*.

1.3. Hispanic Population in the United States

Persons identifying as Latino/Hispanic are the largest minority group in the U.S. The U.S. Census bureau defines Hispanics as those of any race who classify themselves as Hispanic or Latino on a census questionnaire, or fall under the categories Mexican, Mexican-American, Chicano, Puerto Rican, Cuban, or another Hispanic, Latino, or Spanish origin (12). The terms Latino and Hispanic appear to be used interchangeably in the academic literature, with little to distinguish these terms. The term Latino/Latina may be generally preferred, since it makes no linguistic or racial assumptions. The term Hispanic has been used by the U.S. Census since 1980 as a non-gender specific way to assess minority status, and will be used throughout this dissertation for consistency and

ease of use. Despite being grouped into one category, Hispanics are fairly diverse in their country of origin, immigration experience, status within their community, past and current socioeconomic status (SES), and level of acculturation (19). In Texas, 38.1 percent of the population identifies as Hispanic in origin, compared to 16.7 percent in the United States (12). When developing a health intervention for these communities, it is important to know the specific target audience to achieve clear and effective communication.

Mexican immigrants have fewer educational opportunities than US born Hispanics, and thus tend to have lower literacy levels (20). Many Mexican immigrants are employed as unskilled laborers. Age, geographic mobility, and familial employment social network, lead to employment opportunities. In spite of this, the wages in these jobs for Mexican immigrants lag behind those for white and black counterparts (21). This gives Mexican immigrants little opportunity for upward social mobility (22). Texas is a traditional community gateway to Mexican immigrants, and thus has established communities with a shared culture and language (15). This may reduce cultural and language barriers to health care and other services in these communities.

Factors such as socioeconomic status, language barriers, and cultural barriers contribute to health disparities faced by Hispanic populations. Health disparities faced in the Hispanic community are compounded by perceived discrimination from the health care system (23). Additional discrimination may be faced due to language and legal status (24). All of these factors add to stress and marginalization of Hispanics in American society.

1.4. Family Centered Context

Health promotion theory assumes that the individual is an autonomous person who will decide whether to change her behavior based on her perceived personal outcome following the change, as well as her self-efficacy and personal readiness to make a change (22). In addition to these personal factors, she must consider peer and other external influences (22). This type of theory may be less relevant in a traditional Hispanic community or other traditional culture. Hispanics tend to self-identify as a member of their nuclear or extended family (25). For this reason, interventions targeted at autonomous individuals may be less successful than a message aimed at changing the family. Many Hispanics have a fatalistic health attitude, yet this attitude may be altered by making health into a familial concern rather than a personal one (26). Behavior change in Hispanic communities happens in a family context. The family is the primary social support, though this may change with very long term US residence (22). In traditional Hispanic communities, the wife-mother has the role of greatest significance to health interventions. The traditional gender norms and roles make her the leader for change within her family (27). She also has the most influence on the family's diet (28). This wife-mother should be the focus of health education interventions in Hispanic communities.

1.5. Promotoras

Promotoras are also called lay health advisors/educators (LHA), community health workers (CHW), natural helpers, and peer educators. Peer educators as discussed

here began in western society at the end of the nineteenth century, with the rise of public health and public health knowledge (29). Early programs in the US and Europe used women from volunteer organizations to educate other women about childbirth and childrearing (29, 30). Thus women were linked to the role of the CHW in its early modern stages. In the United States, *promotora* model use picked up with the Migrant Act of 1962 (31). The trajectory continued with the Indian Health Service's Community Health Representatives Program in 1968 and the "New Careers" program as part of the Great Society in the 1970s. In the 1970's CHWs were starting to be considered as human capital to increase access to health care and improve health education (29, 32). Interest in *promotoras* was renewed in the 1990s when the Centers for Disease Control and Prevention (CDC) and the Health Resources and Services Administration (HRSA) supported their use as bridges between health services and the community (33, 34). With the twenty-first century, emphasis on prevention as opposed to cure reinforced the role of the CHW/p*romotora* as a peer educator (29).

In 2009, the U.S. Office of Management and Budget (OMB) recognized "community health workers" as an occupation, and in 2010 it became listed as a Standard Occupational Classification (31, 34). Additionally, Texas began credentialing CHWs in 2002. The idea behind *promotoras* is based on the concept of spread of health information through informal and formal social networks. The three main roles in which *promotoras* are employed are health education, advocacy, and serving as a bridge to health care providers or services (35). However, CHWs are primarily employed as service-community bridges in the Northeastern and Central US, and as lay health

educators in the Southern US (31). In Texas, almost three quarters of employers considered health education one of the most important activities of a CHW (36). *Promotoras* should have a large social network within their community. Characteristics sought in *promotoras* are leadership, compassion, and familiarity with the community (22). Because *promotoras* typically deliver the health intervention in person, there is less misunderstanding and increased acceptance of the message. Successful community interventions tend to have clear communication with the community, their organizations, and the families and persons within those organizations (22). The gender and culture of the health education audience should be a primary consideration when selecting *promotoras*. *Promotoras* are able to establish trust with the intervention population. Trust is considered a key value in the Hispanic community, and needs to be established prior to an intervention (14, 15). As trusted community members the *promotoras* are able to incorporate regional dialects and area culture, and overcome literacy issues (14, 15).

Promotora-based programs have been used to train farmworkers and their families about pesticides, and have been shown to be effective (37, 38). A randomized controlled trial evaluating *promotora*-led health education intervention reported a change in nutrition and blood pressure (39). Several studies have been performed on *promotora*-based interventions in nutrition. One study reported increased weight loss in low-income Mexican-American women that were involved in a *promotora*-led intervention focused on portion control (40). In a study by Elder et al. a *promotora*-driven health education intervention was associated with lower intake of sugars and fats, with increased intake of

fiber, than was seen among participants who received tailored or stock print materials alone (16). A systematic review of overweight and obesity interventions in the US in Hispanic children determined that interventions are more effective when participants were at a higher risk, the intervention involved parents, education materials are based in theory, or the study involves older children (22). Further, *promotora*-led interventions have impacts beyond print material, even ones tailored to the community (22). A systematic review of LHA programs concluded that these programs "can achieve significant changes in a variety of health-related factors for Latino populations" (31).

1.6. Webb County Community Characteristics

This work was done in two primarily low SES, Hispanic communities in Texas. The first community comprises incorporated *colonias*, Route 359 *colonias,* and other neighborhoods of Webb County TX. *Colonias* are unincorporated communities that often lack one or more basic community services (41). Most of the residents in Webb County who participated in this study were Spanish-speaking Mexican immigrants or of Mexican origin. Whether living in *colonias*, incorporated *colonias*, or low income areas of Laredo, the people living in these communities have limited access to healthy foods, report a low health-related quality of life, and have a higher prevalence of obesity and diabetes than the general populations of both the U.S. and Texas (42-44). At least 80% of the Webb County participants live at or below the household poverty level, compared to 20% of the Webb County residents (42, 45). *Colonias* often lack or have inadequate access to potable water, sewerage, gas, electricity, garbage collection, and drainage (46).

Additionally, *colonia* and the incorporated *colonia* neighborhoods are self-build lots. For self-build homes, the lots are purchased, and then the homes are built as funds become available. In the *colonias* most people cannot use the land as collateral for home improvement (46). Homes that are self-built often undergo additions and changing functionality of space as funding to build becomes available (46). Many homes in this community lack window screens, air-conditioning, and have cracks where pests can enter homes (data summarized in the table found on page 32). Conditions in these communities may increase household pesticide use.

The incorporated *colonias* in this study *(El Cenizo* and *Rio Bravo*) are still not part of the city of Laredo, but instead each *colonia* is its own municipality. The residents of these incorporated *colonias* have access to trash service, electricity, roads, and water. These incorporated *colonias* have a sheriff and volunteer firemen. These incorporated *colonias* also do not have ambulances or trained first responders (47). These areas are still fifteen to twenty miles from town and lack grocery stores. For emergency health care or other needs the residents would still need to travel to Laredo (47). Many people living in the incorporated *colonias* do not have readily available transportation, thus the residents in the Webb County incorporated *colonias* are living in a more rural area. The residents of the incorporated *colonias* are similar to other Webb County *colonia* residents, but have more municipal services. Like colonia residents and residents of rural areas, residents of the incorporated *colonias* often have less access to health care, than those in urban areas.

1.7. San Antonio Community Characteristics

The second community encompassed residents in the former Kelly Air Force Base (KAFB) area of San Antonio. While this community was urban and incorporated into San Antonio, many of the pesticide use problems facing residents of Webb County remain. Additionally, Hispanics in the zip codes neighboring the former KAFB have a higher incidence of hepatocellular carcinoma than Hispanics in Texas or other races living in this area (48, 49). Halogenated solvents, have been documented in this region (50, 51). *Promotoras* in this community have expressed a concern about pesticide exposures and nutrition (52). Concern over nutrition developed from observed obesity, heart disease, and type II diabetes in the community. Additionally many participants were receiving food, primarily packaged and canned, from local food banks. *Promotoras* were interested in ways to improve the diet of the community members and combat adolescent overweight and obesity. In addition, *promotoras* had observed household pesticide use, and use of illegal pesticides in this community (53).

1.8. Pesticide Use and Effects of Pesticide Exposure

Pesticides are used all over the world to control pests on food crops and in residential areas, and to prevent the spread of vector-borne diseases (54). The U.S. Environmental Protection Agency (EPA) has approved over 300 compounds for use on foods for human consumption or for household pest control. The most often-used classes of insecticides in the US are the organophosphate (OP) and pyrethroid pesticides (55). Organophosphate (OP) pesticides are the most frequently used class of pesticides;

and in 2005, OPs accounted for 70% of insecticide use in the U.S. (55). Compared to organochlorine (OC) pesticides, OP pesticides are less persistent in the environment, but chronic low dose OP exposure may produce neurotoxicity (56-59). Pyrethroid pesticides are synthetic analogues of naturally occurring plant-based pesticides. These are less toxic than OP pesticides and less persistent than OC pesticides. However, pyrethroids are not as efficacious in pest control and improper use of these pesticides may lead to systemic poisoning (60, 61). The pyrethroids permethrin, tetramethrin, and bifenthrin, are classified as possible carcinogens by the U.S. Environmental Protection Agency (EPA).

The adverse health effects from OP pesticides are associated with their ability to inhibit the enzyme acetylcholinesterase (AChE), but only in acute exposures. Inhibition of AChE results in an accumulation of the neurotransmitter acetylcholine (ACh) in the synaptic cleft between neurons. The persistence of ACh leads to hyper-stimulation of neurons affecting the central and peripheral nervous system. At lower doses, other mechanisms of neurotoxicity have been proposed, such as blocking the fibroblast growth factor super-family tyrosine kinases, disrupting the adenylyl cyclase signal cascade, which is involved in neurodevelopment and repair and oxidative stress (62, 63). Recent studies on gene-environment interactions have found an association between polymorphisms of the paraoxonase-1 (PON1) gene and increased vulnerability to the toxic effects of OPs (64, 65). Fukuyama et al. described induction of apoptosis in thymocytes, due to application of OP and OC pesticides, used individually (40). This induction may predispose a developing fetus to autoimmune disorders (66).

While the acute toxicity of pesticides described above is well documented, the health effects of low dose or chronic exposures are not as well understood. People tend to be exposed to low chronic doses of pesticides. The effects of chronic OP exposures may include neurophysiologic deficits, neurobehavioral problems, reduced fertility, birth defects, and cancer (57, 58, 67). Bouchard et al. have shown an association between OP pesticide exposure and IQ deficit in children under the age of seven (68). The neurotoxic effects of OP pesticides can have marked effects on a conceptus or young children in the stages of neurodevelopment (69). Furthermore, OP pesticides are able to pass through the placenta and have been measured in amniotic fluid (49, 70). While the education interventions in this study did not target pregnant women, the mothers of young children were the target audience. These women may seek to have more children or know women planning to have children with whom they may share information.

People may be exposed to mixtures of pesticides from diet, household pest control, and other environmental and occupational routes. Mixtures are difficult to study and much work is needed in this area. Humans and other mammals require carboxylesterases to detoxify pyrethroid pesticides and some OP pesticides can inhibit these enzymes (71). Prenatal exposure to mixtures of OPs and pyrethroid pesticides have been found to be associated with reduced birth weight and increased body fat accretion in childhood, and these effects were potentiated by maternal smoking (72) Acetylcholinesterases inhibition is responsible for most acute OP poisonings; however, the mechanism of acetycholinesterase inhibition and inhibition of carboxylesterases are

not connected. Consequently, the acute toxicity of OPs and the ability of OPs to potentiate pyrethroids occur via unrelated mechanisms (60, 73).

Despite the fact their children have increased susceptibility to environmental exposures, and compose 30% of the US population, in 2000 only 3% of federal research funds went to research on children's health (74). Children's environmental exposures are of exceptional concern, because they have a higher food intake, ingest more water, and require more air per unit body weight than adults. These increased functions are likely to expose children to larger amounts of pesticides per unit body weight than an adult. Parental occupational exposures and children's crawling and mouthing behaviors may also increase children's pesticide exposures (14, 57, 75-77). As children are still developing, they are more susceptible to the harmful effects of pesticides. The metabolic pathways of young children are not completely developed. Thus, immature metabolic pathways may inhibit activation of toxicants, but are more likely to decrease children's pesticide detoxification processes (78, 79). The nervous, immune, and reproductive systems of young children are also undergoing development, increasing the susceptibility of these systems to pesticide exposures (80). Holland et al. reported that children had at least 3-fold lower levels of PON1 compared to their maternal levels in the Center for the Health Assessment of Mothers and Children of Salinas (CHAMACOS) study. PON1 is involved in OP pesticide detoxification. The Holland study suggests that Hispanic children may more susceptible than Hispanic adults to the harmful effects of OP pesticides (81). In addition, children have more potential years of life than do adults, permitting time for chronic diseases and cancers to develop (80).

While the primary route of pesticide exposure for most people is food consumption, children have additional exposures to household pesticides due to their behaviors (82). The majority of non-dietary exposures may be household pesticide exposures (83, 84). The low vapor pressures and other chemical properties of pyrethroids and OPs promote adherence to dust particles (85). Pesticide residues may persist indoors because of the lack of environmental factors that degrade them (84). Children in the crawling phase may ingest as much as 10 grams of dust and dirt in one day (86). Additionally, data from Poison Control Centers concludes that even in agricultural areas, children under the age of 6 are typically exposed to greater levels of pesticides through household use than they are through agricultural use (87). Pesticide exposures in urban settings may also be different from those in the more studied agricultural and rural settings (82, 88). Thus, indoor pesticide exposures and household pesticide use may be a substantial source of pesticide exposure in young children. *Promotoras* and researchers have noticed household pesticide use, use of illegal pesticides, and inappropriate use of pesticides in homes in Webb County (53, 89, 90). Concerns about pesticides were also raised by *promotoras* in San Antonio (52).

1.9. Nutrition, Obesity, and Obesity-Related Illness

In the U.S., six out of every ten women are overweight or obese. These numbers rise to seven in ten for Mexican American women (91). An additional 13 percent increase in obesity is seen in Mexican American women living below the poverty level (91). Many different factors may contribute to this disparity, including cultural factors,

environmental factors, social factors, health literacy, nutrition knowledge, decreased use of preventative services, and poorer overall health (92, 93). Family customs may also be a barrier to dietary change.

Parents and other family members have significant influence over the nutritional knowledge, behaviors, and physical activity of Hispanic youth (94, 95). Mexican – American boys and girls, ages eight to sixteen, have higher rates of obesity at 39.1 percent than non-Hispanic whites at 27.9 percent (91, 96). The CDC designates children between the ages of 2 and 19 obese if they fall into the 95th percentile or higher of BMI (97). One in six Hispanic children between the ages of 2 and 5 is obese. Obese children in this age range are more likely to have obesity-related diseases, such as high cholesterol, type II diabetes, asthma, and sleep disordered breathing, later in childhood or adolescence (98).

Obese and overweight children may also be more likely to experience depression and low self-esteem (99). Patterns of fat distribution and differences between ethnicities in BMI may be established at age five or six (100). Obese children are more likely to become obese adults. Further, obesity is difficult to treat once it has been established (101, 102). In one study a small sample of Hispanic children of any weight were challenged with sugary beverages. These children had a decreased acute insulin response, and showed early signs of beta cell dysfunction (103). Beta cell dysfunction increases risk for type II diabetes. Prevention or treatment of obesity should begin in childhood to prevent obesity-related diseases, particularly type II diabetes, in adulthood (104).

Acculturation of adult Hispanic immigrants is correlated with lower likelihood of obesity (105). Immigrant Hispanic children are less likely to be overweight or obese than children born in the US to immigrant parents (106). Parents of young children may not think of overweight as a problem. In some cultures, chubbiness in children is seen as a sign of prosperity and child health (107). This decreases buy-in for interventions targeting overweight and obesity in children under the age of 6 (108). In addition, adolescents with private insurance may be less likely to be overweight or obese than those with public insurance (109). Insurance is related to parental SES and type of employment (106). Parental SES, education, and immigrant status may influence children's BMI. However, with acculturation as a factor, changes in SES may not benefit the Hispanic population in the same way as other populations (106). Less culturally integrated adolescents are less likely to be obese even with a low SES (108). Parental language is also linked to certain trends in children's BMI. Children of Spanish speaking parents are less likely to have diets higher in macronutrients (low calorie, higher energy foods), are more likely to have lower education levels and make poorer food choices than children of English-speaking parents (105). The combination of low SES and ethnicity may combine synergistically to increases the likelihood of obesity, and further entrench health disparities (110).

Interventions targeting obesity in childhood may be more efficacious in the long-term, than targeting already overweight or obese adults (111). However, these interventions should target the family not just the children. Adolescence may be a critical period in which patterns that establish obesity occur, making adolescents, as well

as with younger children, an important intervention target audience (112). Involving parents while targeting children may be important in combating obesity and obesity-related diseases. Children under the age of 10 are twice as likely to be obese adults, regardless of their BMI, if their parents are obese (113).

1.10. Health Education Modules

The pesticide module (titled Home Safety) was developed in response to observed behaviors and home characteristics in Webb County *colonias* during previous environmental sampling. Most of the module focuses on household pesticide use. The proper use, storage, and handling of pesticides are emphasized, as well as the effects pesticides may have on children. There is also information on pesticides that are sold illegally for household use (unregistered with EPA for home use) and why these pesticides may be dangerous for use in the home. The module addresses some integrated pest management techniques for reducing pests in the home without pesticides. In addition, this module addresses what should be done if a child or family member is exposed to pesticides. The module begins by explaining the special vulnerabilities of children and why home safety is important in keeping children healthy. In addition, this module also addresses other chemical, physical, and electrical hazards in the home. The importance of disposing of frayed cords, turning appliances off when not in use, and keeping appliances away from water are addressed. The module also covers chemical household hazards such as cleaners, fuels, polishes, and batteries. The importance of reading labels of household chemicals is stressed.

The nutrition module is titled "Healthy Food, Healthy Families". This module was developed to address concerns expressed by the FSA Community Liaison and *promotoras*, and they were involved in determining the specific content of this module. The module starts by addressing the importance of nutrition, exercise, and the growing problem of obesity. One proposed issue in the growing obesity problem is changing perceptions of portion size. Supersized portions or larger portions at restaurants have skewed many people's perceptions of what a reasonable portion should be (114). Decreasing portion sizes decreases caloric intake. To address portion sizes effectively, education and education aids on correct portion size are needed (115). Efficacy of portion size control is increased by addressing portion sizes explicitly, and not focusing on what should be eaten (116). Another issue is food choice. Many Hispanics consume 4 servings or fewer of fruits and vegetables per day, as opposed to the USDA-recommended 6 or more servings per day (117). Low fruit and vegetable intake may lead to magnesium deficiency which may increase insulin resistance in children who are obese (117).

The module covers portion sizes, recommended servings, a balanced diet, how to read nutrition labels, foods to avoid or substitute, soft drinks, water, losing weight, tips for dietary changes for picky eaters, and physical activity. Participants are also given a handout from MyPlate.org for home reference. While many topics are covered, the module stresses making changes one at a time beginning with something the family is most likely to accept.

1.11. Specific Aims

In this study, environmental health education modules were developed and presented to address potential areas of low health literacy. The topics addressed were areas relevant to the study communities. The efficacy of the health education modules were assessed by changes in participant knowledge attitudes and behaviors prior to, immediately after, and months following the module. There are three topics addressed in this dissertation: (1) an assessment of the changes in knowledge, attitudes, and behaviors associated with participation in a home safety/pesticide environmental health education in Webb County, TX**,** (2) an assessment of the changes in knowledge, attitudes, and behaviors following a healthy habits nutrition educational module in San Antonio, TX and (3) a comparison of changes in attitudes and behaviors following a pesticide health education module in two Hispanic communities (San Antonio and Webb County, TX).

2. CHANGES IN KNOWLEDGE, ATTITUDES, AND BEHAVIORS FOLLOWING A *PROMOTORA*-DRIVEN PESTICIDE-FOCUSED HOME SAFETY EDUCATION INTERVENTION IN WEBB COUNTY, TX

2.1. Overview

There is widespread use of pesticides to control pests on food crops and to prevent the spread of vector-borne diseases (54). The U.S. Environmental Protection Agency (EPA) has approved over 300 compounds for use on foods we consume or for household pest control. While the acute toxicity of pesticides is well known, the effects of chronic or low dose exposures are less well understood. Two classes of insecticides that are frequently used in the US are the organophosphate (OP) and pyrethroid pesticides (55). According to the U.S. Environmental Protection Agency, organophosphate (OP) pesticides are the most commonly used class of pesticides and accounted for 70% of insecticide use in the U.S. in 2005 (55). Some studies have reported adverse health effects due to chronic OP exposure including birth defects, neurophysiologic deficits, neurobehavioral problems, infertility, and cancer (57, 58, 67). One recent study has shown an association between OP pesticide exposure in children and IQ deficit (68). Fukuyama et al. reported that OP and organochlorine (OC) pesticides, used separately, induce apoptosis in thymocytes, which may predispose a developing fetus to autoimmune disorders (66). Pyrethroids tend to be less toxic than OPs; however, improper use of pyrethroids may lead to systemic poisoning (60, 61). Pyrethroids are suspected endocrine disrupters, and may mimic estrogen. Pyrethroids

may suppress the luteinizing hormone pulse, and potentially disrupt the circadian rhythm (60, 118). Additionally, people are exposed to mixtures of pesticides from foods, household spraying, and other environmental and occupational routes. OP pesticides can inhibit carboxylesterases mammals need for ester hydrolysis to detoxify pyrethroid pesticides (71). The inhibition of acetylcholinesterase is responsible for most acute OP poisonings, but is unrelated to inhibition of carboxylesterases. Thus the toxicity of the OPs is unrelated to the ability of OPs to potentiate pyrethroids (60, 73). A recent study showed that prenatal exposure to mixtures of OP and pyrethroid pesticides was associated with lower birth weight and increased body fat accumulation in childhood, which was potentiated by maternal smoking (72). Pyrethroids alone or in combination with OPs may affect sperm count, motility, and morphology (119, 120). The health effects of mixtures are difficult to assess and more study is needed in this area.

Children are of special concern, because per unit body weight they eat more food, drink more water, and breathe more air than adults, and thus may be exposed to larger amounts of pesticides. Children may also be exposed to pesticides through parents working in agriculture and through crawling and mouthing behaviors (14, 57, 75-77). Furthermore, children are still developing and are more vulnerable to the adverse effects of pesticides. Metabolic pathways in young children are not yet fully developed. The immature metabolic pathways sometimes interfere with activation of toxicants, but are more likely to reduce children's ability to detoxify pesticides (78, 79). A study by Holland et al. reported that children in the CHAMACOS study had 3- to 4-fold lower levels of paraoxonase 1 (PON1) when compared to their mothers. Since PON1 is

involved in detoxifying OP pesticides, this study suggests Latino children are more vulnerable to the adverse effects of OP pesticides than are Latino adults (81). The immune, nervous, and reproductive systems of young children are also still developing, rendering these systems more vulnerable to pesticide exposures (72-74). Additionally, children have more years ahead of them than do adults, allowing time for chronic diseases to develop (80). Decreasing pesticide exposure in children may have profound impacts on their future health and behavior.

Programs using *promotoras* to educate agricultural workers about pesticides have been found to have varying effectiveness (37, 38). Because *promotoras* typically deliver the health intervention in person, there is less misunderstanding and increased acceptance of the message. Successful community interventions tend to have clear communication with the community, their organizations, and the families and persons within those organizations (22). A systematic review of lay health advisor (LHA) programs concluded that these programs "can achieve significant changes in a variety of health-related factors for Latino populations" (31). In addition, *promotora*-led interventions have impacts beyond print material, even ones tailored to the community (22).

While most people are exposed to pesticides through food consumption, children are also exposed to household pesticides by their behaviors (82). Household pesticide exposure may account for the majority of non-dietary exposures (83, 84). OPs and pyrethroid pesticide residues may persist indoors without the rain, sunlight, and heat that degrades pesticides outside (84). Additionally, national Poison Control Center data

suggests that even in agricultural areas, children under the age of 6 are more likely to have acute pesticide poisonings through household use than work-related use (87). Household pesticide use and indoor pesticide exposures may be a significant source of pesticide exposure in children. During previous research and discussions with *promotoras*, our research group has identified illegal pesticide use and inappropriate pesticide use in homes as concerns in Webb County, TX. In response, a pesticide education module addressing these topics was developed, and *promotoras* who had a previously established relationship with the community were employed to deliver this module to families in Webb County. To our knowledge, this is the first study of this type that has addressed home pesticide use in non-agricultural communities. The purpose of the health education intervention study was to assess whether or not *promotora* driven home health education can have a persistent impact on the knowledge, behaviors, and attitudes of community participants.

2.2. Methods

2.2.1. Home Safety Module and Assessments

The health education module used in this study was focused primarily on pesticide safety and also covered other home safety concerns, with an emphasis on risks to children. Specific pesticide-related topics covered in this module were determined based on pesticide use practices in South Texas. The module went into detail on risks associated with pesticides. Potential health effects of pesticides on adults and children

were described, and the proper handling, use, and storage of pesticides were also covered. In addition, the module covered illegal pesticides, e.g. pesticides sold for home use that have not been approved by the U.S. Environmental Protection Agency (EPA) for this purpose, and why these pesticides are dangerous. The module also covered physical, electrical, and chemical dangers encountered in the home. Physical dangers described included leaks, standing water, placement of heat sources, and tripping hazards. The electrical dangers discussed were frayed cords, placement of appliances, and electrical outlets. Chemical hazards, other than pesticides, included sources of carbon monoxide, and household cleaners. Review and translation of the modules into culturally appropriate Spanish was accomplished by bilingual project staff including researchers and *promotoras*.

Assessments covered participant demographics, home pesticide use-related characteristics, home safety-related attitudes, and home safety-related behaviors. The individual questionnaires can be found in Appendix I. These assessments were reviewed and translated by bilingual *promotoras* and researchers into culturally appropriate Spanish.

2.2.2. Promotora Recruitment and Training

The *promotoras* who participated in the study had worked as lay health advisors in Webb County for over seven years prior to the start of this study. The *promotoras* attended a training session in which the module was delivered by researchers and the promotoras were able to ask any questions. After this module training, the *promotoras*

took the four assessments that were designed for the participants, including a demographic survey, a knowledge test, a behaviors survey, and an attitudes survey. This assessed gaps in *promotora* knowledge and familiarized the *promotoras* with the assessments and potential problems. If a *promotora* had not performed well on the knowledge test, that *promotora* would have been retrained with particular attention to knowledge gaps, and retested until she was comfortable with the information in the module. The *promotoras* then each delivered the module as a project researcher listened. This enabled the researchers to assess the *promotoras'* skills with module delivery and ensure the information was presented correctly.

2.2.3. Participant Eligibility, Recruitment, and Characteristics

To be eligible for the study, participants were required to be at least 18 years of age, and have children between the ages of six-months and 5 years living with them. Children in this age group are most likely to exhibit behaviors that increase pesticide exposure. The participants were selected from low income Hispanic neighborhoods in Webb County. Many homes in these areas lack window screens, air-conditioning, and have cracks where pests can enter homes. Conditions in the study neighborhoods promote household pesticide use. Participants were excluded from the study if they had received home-safety education prior to this study.

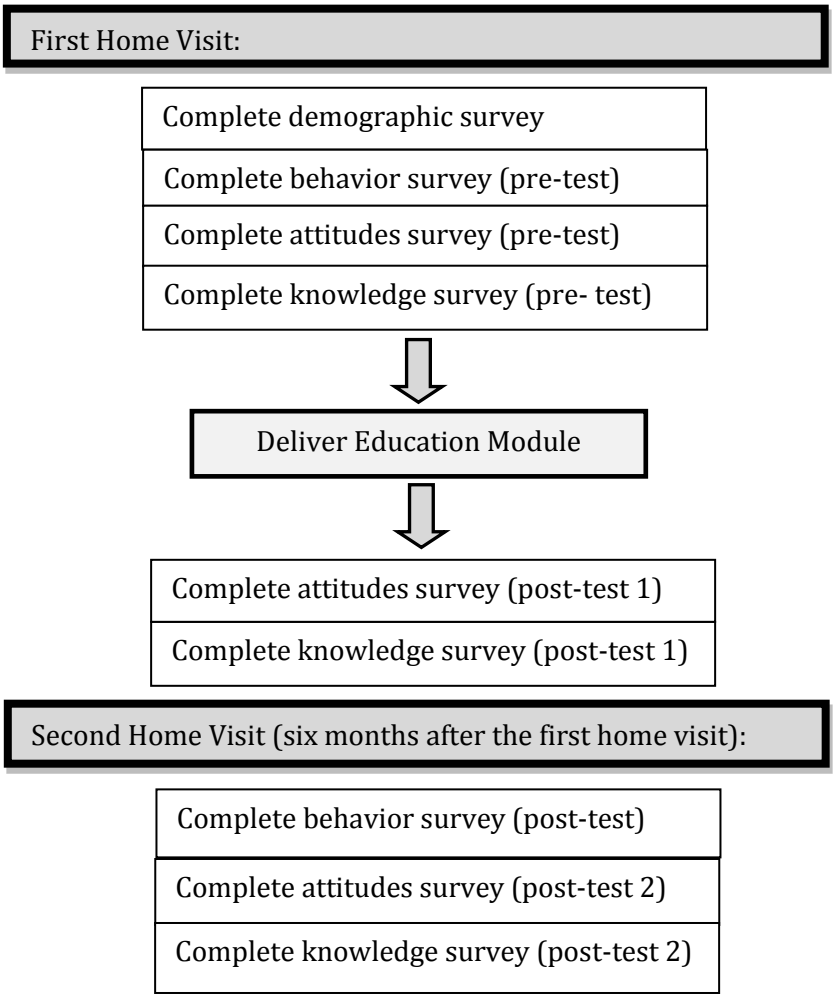
The *promotoras* recruited participants through personal social networks or by door to door soliciting. Due to the length of the visits, participants were compensated

with a $20 and a $10 grocery gift card at the end of the first and second home visit, respectively.

2.2.4. Structure of the Intervention

Promotoras held two home visits with study participants. In the first visit, following completion of the informed consent process, participants were given four pre-module questionnaires with questions relating to demographics, knowledge, attitudes, and behaviors. After completion of the pre-tests, *promotoras* delivered the health education module, engaged the participant in discussion, and answered any questions. After completion of the module, the participant filled out post-test questionnaires on knowledge and attitudes. The second home visit was scheduled for six months after the delivery of the education module. In this second visit, *promotoras* delivered questionnaires to assess knowledge, attitudes, and behaviors. For each test, the pre-tests and post-tests were identical. A brief summary of the intervention activities is shown in Figure 2.1.

Figure 2.1 Intervention Activity Schedule



2.2.5. Data Analysis

Each participant's pre- and post-intervention knowledge assessment score was summed to produce an outcome variable. A paired t-test was used to determine if there was a difference between the means of the score outcome variables of the pre and post-tests for the knowledge assessment. Incomplete cases were not included in the summed score analysis. With limited variation in the participant demographics and a small sample size, imputation was not considered to be feasible.

Changes in binary measures between the pre-test and the post-tests for individual test items relating to knowledge, attitudes and behaviors were assessed by McNemar's chi square. When the variables were categorical, the Wilcoxon signed rank test was used to determine the significance of the changes between the pre-test and the post-test questions. There were a large number of tests of significance performed in this analysis. For this reason, Bonferroni adjustments were made to the significance tests. In the analyses done in this project, the conservative Bonferroni adjustments did not change the significance when compared with the less stringent 95% confidence level. All statistical analysis was conducted using STATA /IC 11.0 (Stata software, version 11.0, Stata Corp., College Station, Texas).

2.2.6. Permission for Human Subjects Research

This project was approved under UTHSCSA IRB Protocol # HSC20100383E, and Texas A&M University IRB Protocol # 2009-0892.

2.3. Results

2.3.1. Pesticide Use-Related Conditions

The *promotoras* gave the pre-tests, delivered the home safety module, and delivered the immediate post-tests to 146 individuals. Of these 146, 135 individuals completed the six month follow-up visit and all post-tests, resulting in a 92% retention rate. The demographic characteristics for the participants are summarized in Table 2.1. Almost all (99%) of the participants were women. Most of the participants were born in Mexico, preferred Spanish, were not high school graduates, and had yearly incomes under $17,000. Approximately half of the participants were married. Most of the participants were not employed, but had a spouse that was employed. Only two participants reported employment in agricultural work.

The participants were given an assessment of pesticide use-related conditions in their homes prior to the module. The results of this assessment are summarized in Table 2.2. Most participants (59%) lived in single family detached homes or in a mobile trailer home (12%), giving them control over pesticide use in the home. Most participants had local garbage pick-up (89%) and went less than one week between garbage pick-ups (94%). This suggested that lack of adequate garbage collection, which could attract stray animals and pests, was not a major concern.

The climate in Webb County is very warm for several months of the year. If a home does not have air conditioning, windows are kept open much of the year, and pests are able to enter through open windows that do not have screens. A total of 34% of the

Table 2.1. Demographic Characteristics of Study Participants

Characteristics		N*=146	(%)
gender			
	female	142	(98.6)
	male	2	(1.4)
country of origin			
	Mexico	108	(74.5)
	U. S.	34	(23.4)
high school graduate			
	no	89	(64.5)
	yes	49	(35.5)
employment			
	participant employed	32	(22.2)
	spouse employed	97	(84.4)
married			
	no	73	(50.7)
	yes	71	(49.3)
preferred language			
	English	15	(10.3)
	Spanish	130	(89.7)
first language learned			
	English	10	(6.9)
	Spanish	135	(93.1)
second language learned			
	English	55	(38.2)
	Spanish	8	(5.6)
	none	81	(56.2)
yearly income category			
	< $8,999	67	(54.5)
	$9,000 - $16,999	40	(32.5)
	>$17,000	16	(13.0)
*Not all participants answered all questions			

Table 2.2. Characteristics of Pesticide-use Related Conditions in Participant Homes

	Description	N=144*	(%)
Type of home			
	single family detached	86	(59.3)
	single family connected	30	(29.7)
	Multi-family home	11	(7.6)
	trailer/mobile	17	(11.7)
	Garbage disposal		
	local pick-up	129	(89.0)
	burn	1	(0.7)
Garbage collection			
	less than one week between pick-up	136	(93.8)
	once per week	2	(1.4)
	more than one week between pick-ups	5	(3.5)
	Air conditioning		
	have A/C	94	(65.7)
Window screens			
	no windows have screens	28	(19.8)
	half or less of the windows have screens	24	(16.6)
	more than half of the windows have screens	18	(12.4)
	all windows have screens	75	(51.7)
	Efficacy:		
	window screens are effective	125	(86.9)
	Pest problems		
	pest problems in last six-months	56	(38.9)
	ants	94	(65.3)
	roaches	80	(55.6)
	fleas	40	(27.8)
	wasps	57	(39.6)
	rats or other rodents	34	(23.6)
	Pesticide home use		
	used in home in last six-months	98	(68.1)
	professional pesticide application	22	(15.3)
	continuing pest problems	90	(62.5)
	plan to use something else for pest control	88	(61.1)
Pets			
	have indoor pets	27	(18.8)
	use flea/tick control	19	(13.2)
Pesticide labels			
	understand English labels	82	(56.9)
	understand Spanish labels	136	(94.4)
	Have you ever used:		
	airplane powder (methyl parathion)	9	(6.3)
	DDT	9	(6.3)
	Chinese or miraculous chalk	37	(25.7)

*Not all participants answered all questions. This assessment was given before the intervention.

participants did not have air-conditioning, and 48% did not have screens on all of their windows. Many (92%) of the people with all of their windows screened were among those with air-conditioning (data not shown). Screens were effective at keeping out pests for most participants (87%), however; a total of 13% of the participants said that their screens were not effective at keeping out pests. The participants without screens on all windows or air-conditioning are likely to have pest problems in this climate.

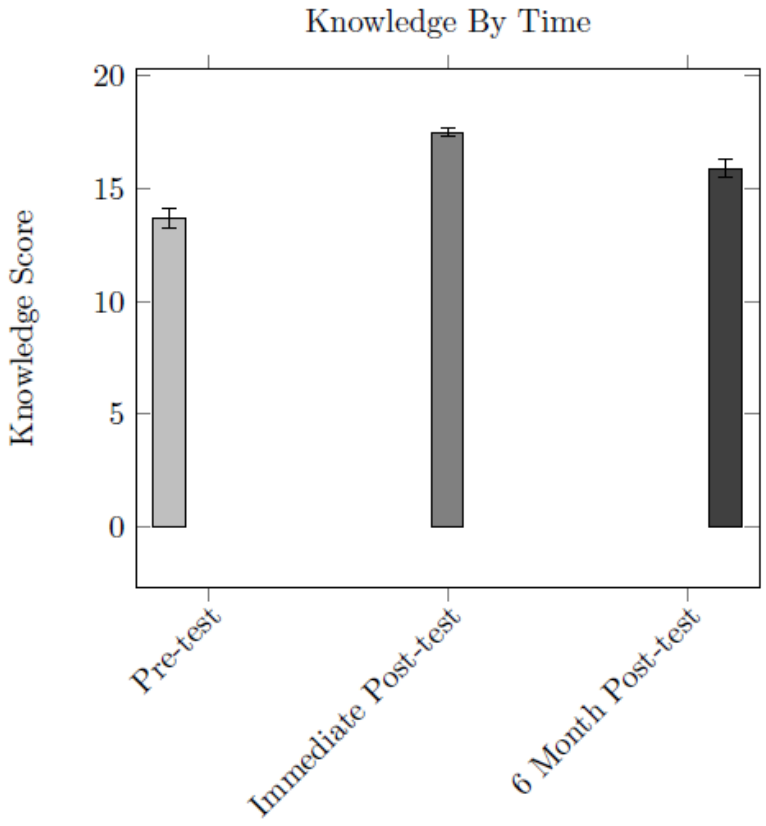
Many participants had pets, and 19% of participants kept pets inside. A total of 13% used some form of flea and tick control for their pets. A little over one-third (39%) of the participants said that they had had pest or weed problems in the past six months, but 68% reported using pesticides in their home in the same time period. Only 15% reported hiring professional exterminators for pest control. Participants reported problems with ants, roaches, flea, wasps, and rodents, with ants being the most commonly-reported pest (65%). Over half of the participants (62%) reported continuing pest problems and planned to use something else for pest control (61%).

A little over half (57%) of the participants reported that they were able to understand pesticide labels written in English, while 94% of participants were able to understand pesticides labels in Spanish. A quarter of the participants (26%) have used Chinese or miraculous chalk, an illegal pesticide that is commonly used in South Texas. About six percent (6%) of the participants reported using the illegal pesticide "airplane powder" (methyl parathion). Finally, 6% of the participants reported using DDT.

2.3.2. Changes in Knowledge

A summed score for the knowledge test was constructed for each participant that answered all 18 test items. Figure 2.2 shows a comparison between the scores of the knowledge pre-test and both post-tests. Of the 129 participants completing the knowledge pre-test, the mean score was 13.68 (99.38%CI: 13.24, 14.13).

Figure 2.2. Comparison of Knowledge Pre-test * and Post-test† Scores‡



The error bars represent confidence intervals for the mean score.
* N=129 for the pre-test
† N=131 for the immediate post-test, and N=130 for the six-month post-test
‡ The maximum score for these assessments was 18.

The 131 participants that completed the immediate post-test had a mean score of 17.48 (99.38%CI: 17.30, 17.66). Finally, the 130 participants completing the six-month post-test had a mean score of 15.89 (99.38%CI: 15.48, 16.31). The confidence intervals for the mean score are not overlapping, indicating a statistically significant difference between the pre-test and each post-test. A summary of the mean differences in scores between the pre- and post-tests is shown in Table 2.3. The mean score difference between the immediate post-test and the pre-test was 3.87 (99.38%CI: 3.37, 4.37). The mean score difference between the six-month post-test and the pre-test was 2.21 (99.38%CI: 1.65, 2.76).

Table 2.3. Mean Differences in Summed Knowledge Scores

Tests*:	**Mean Score difference†**	**CI: 99.38%**
Pre-test and immediate post-test	3.87	(3.37, 4.37)
Pre-test and 6-month post-test	2.21	(1.65, 2.76)

* Only complete cases (all knowledge questions answered) were used, N=129

†Paired t-tests with Bonferroni adjustment.

On the individual test items, participants made significant improvement in knowledge on 13 items between the pre-test and six-month post-test. The individual test items and participant responses are shown in Table 2.4. The questions for which the

Table 2.4. Correct Responses to Individual Knowledge Assessment Items on the Pre-test and Six Month Post-test

Question	**Pre-test** N=146 (%) correct	**6-month Post-test*** N = 135 (%) correct	P-value
Children are more vulnerable to household dangers - *from increased exposure and ongoing development*	72 (49.7)	101 (74.8)	<0.0001†
Allergies or asthma may be affected by the use of pesticides. - yes	134 (92.4)	125 (92.6)	0.78†
Pesticide poisonings may have immediate but not delayed effects. -no	51 (35.2)	67 (49.6)	<0.0001†
Pesticides may cause birth defects and nerve damage. -yes	127 (87.6)	123 (91.1)	0.28†
Some people can get sick from pesticides faster than others …-yes	120 (82.8)	128 (94.8)	0.002†
It is safe to allow children to play right after you have treated their play area with pesticides.- no	142 (97.9)	133 (98.5)	0.65‡
How long should you stay out of areas after it has been treated with pesticides? 24-48 hours	25 (17.2)	72 (53.3)	<0.0001†
When using pesticides, you should always follow the directions printed on the label	127 (87.6)	131 (97.0)	0.002†
Soap and cold water can remove pesticides from hands. -yes	83 (57.2)	115 (85.2)	<0.0001†
Pesticides can enter the body through the skin. –yes	123 (84.8)	128 (94.8)	0.004†
Which of the following pesticides is illegal in the United States…? Chinese chalk	76 (52.4)	129 (95.6)	<0.0001†
These [picture of soda/water bottles] containers can be used to store pesticides. - no	138 (95.2)	135 (100)	0.014‡
It is OK to store water in containers that have been used for storing pesticides.- no	142 (97.9)	130 (96.3)	0.48‡
Which of the following is a safe way to store pesticides? High cabinet	128 (88.3)	132 (97.8)	0.002‡
It is a good idea to store pesticides where small children can reach them…-no	140 (96.5)	132 (97.8)	0.71‡
This [picture of bleach] is a hazardous product. - yes	130 (89.7)	131 (97.0)	0.012‡
Which of the following is NOT a hazardous household product? Baking soda	103 (71.0)	112 (83.0)	0.048†
Which of the following is OK to do? Use appliances away from sinks and tubs.	117 (81.3)	119 (90.2)	0.012†

* Post-tests were given six months after the Pesticide Health Education Module intervention
† McNemar's Chi Square with Bonferroni adjustment (α = 99.38%)
‡ Wilcoxon sign rank test (α = 95%)

changes in knowledge were significant regarded: the increased vulnerability of children to pesticides (50% on the pre-test, and 75% on the post-test); the importance of reading pesticide labels (88% on the pre-test, and 97% on the post-test); keeping children away from areas in which pesticides were applied (17% on the pre-test, and 53% on the post-test); cleaning hands with cold water and soap after use of pesticides (57% on the pre-test, and 85% on the post-test); illegal pesticides (52% on the pre-test, and 96% on the post-test); people may have different reactions to pesticides (83% on the pre-test, and 95% on the post-test, and safe storage of pesticides (88% on the pre-test, and 98% on the post-test).

2.3.3. Changes in Attitudes

The attitudinal questions and changes in participant responses are summarized in Table 2.5. Most people began the study thinking that pesticides could cause health problems (89%), and at the six-month post-test 100% of the participants thought pesticides could cause health problems. During the pre-test, 42% of participants never thought about the health effects of pesticides, but that decreased to 31% six months later. Participants' belief that current use of pesticides could affect their future health increased from 64% before the training to 83% on the six-month post-test. Sixty percent of the participants believed that pesticides could affect the health of children during the pre-test, but on the six-month post-test this percentage increased to 83%. Finally, the percent of participants that felt they had some or a lot of control over avoiding the

Table 2.5. Changes in Participant Responses to Attitudinal Home Safety Questions

Question	Response	Pre-test N = 146 (%)	6-month Post-test* N = 145 (%)	P-value
Do you think pesticides can cause health problems?	yes	128 (88.9)	145 (100)	0.045‡
How often in the past month have you thought about health effects of pesticides?	never	61 (42.4)	44 (30.8)	0.002†
Do you believe your past or current use of pesticides will affect your future health?	yes	92 (64.3)	121 (83.5)	<0.0001†
Do you believe that pesticides can affect the health of children?	yes	90 (60.0)	125 (83.3)	<0.0001†
How much control do you feel you have over avoiding negative effects of pesticides?	some/a lot	90 (62.5)	128 (88.3)	<0.0001†
Have you ever become sick from being around pesticides?	yes	11 (7.6)	16 (11.0)	0.13†

*Post-tests were given six months after the Pesticide Health Education intervention
†McNemar's Chi Square with Bonferroni adjustment (α = 99.38%)
‡ Wilcoxon sign rank test (α = 95%)

negative effects of pesticides increased from 62% on the pre-test to 88% on the six-month post-test.

2.3.4. Changes in Behaviors

The results of the initial and six-month behavior assessments are summarized in Table 2.6. There were statistically significant changes in behavior for all of the behaviors measured in the survey. One hundred percent of the participants reported knowing that it was necessary to wash their hands after using pesticides on the six-month post–test compared to 94% on the pre-test. Also, 99% of participants reported using cold water to wash their hands on the six-month post-test, compared to 71% on the pre-test. A similar response was seen for reading the labels before applying pesticides, with 79% reported this behavior on the pre-test and 100% reporting the behavior six months later. More participants reported keeping pesticides out of reach of children on the six month post-test (99%) than on the pre-test (86%). More participants also reported not using damaged electrical cords the post-test (99%) than on the pre-test (84%). Fewer participants reported having standing water or moisture in their home in the post-test (5%) than on the pre-test (26%). After the module 93% of participants reported not keeping pesticides in unmarked containers as opposed to the 69% reporting this behavior before the module. The largest percentage gains were in use of gloves when applying pesticides and keeping emergency phone numbers next to the phone in case of a poisoning. In the former case, 94% of the participants reported using gloves on the post-test, while only 46% reported using gloves on the pre-test. In the latter case,

only 44% of participants kept emergency phone numbers next to their phone before the training, but six months later 92% of participants reported keeping emergency phone numbers next to the phone.

2.4. Discussion

2.4.1. Pesticide Use-Related Conditions

Having frequent local garbage pick-up, as most participants reported on the pre-test, decreases the chances that trash will accumulate and attract pests. Since there were a large number of participants without full screens or air-conditioning, pests were likely to enter the home through their windows. *Promotoras* have reported seeing participants spray pesticides while cooking to eliminate pests flying in through unscreened windows (53). Efforts have been made to connect participants and others in the area with weatherization programs to combat this point of entry for pests. Weatherization programs should be promoted as one way to decrease pests and thereby reduce pesticide use in low-income families.

Table 2.6. Changes in Participant Responses to Behavior-based Home Safety Questions

Question	Desired response	Pre-test N = 146 (%)	six-month Post-test* N = 145 (%)	P-Value
I wash my hands with cold water after using pesticides	always	103 (71.5)	144 (99.3)	<0.0001‡
It is necessary to wash my hands after applying pesticides	always	135 (93.8)	145 (100)	0.003‡
I keep pesticides out of the reach of my children	always	125 (86.1)	143 (98.6)	0.0001†
I use electrical cords which are damaged	never	121 (84.0)	144 (99.3)	<0.0001‡
I read the instructions on the label before applying pesticides	always	114 (79.1)	145 (100)	<0.0001‡
I use gloves when applying pesticides	always	66 (45.8)	136 (93.8)	<0.0001†
I have emergency phone numbers next to the phone in case of a poisoning	always	64 (44.4)	134 (92.4)	<0.0001†
I keep pesticides in unmarked containers	never	99 (68.8)	135 (93.1)	<0.0001†
I have areas of standing water or moisture around my home	never	111 (74.0)	137 (94.5)	<0.0001†

*Post-tests were given six months after the Pesticide Health Education intervention
†McNemar's Chi Square with Bonferroni adjustment (α = 99.38%)
‡Wilcoxon sign rank test (α = 95%)

One of the messages of the module was that participants should always read the directions on the pesticide label. This message may not be persistent without Spanish language pesticide labels available on pesticides. Many people are not aware that pesticides must be approved by the EPA, and those pesticides that are legal for sale in the United States must have registration information on the label. Miraculous or Chinese chalk is a pyrethroid insecticide that looks like chalk. The formulation is highly variable, but the label says that the chalk is safe for use. Insecticide chalk and methyl parathion, more commonly referred to as airplane powder, are sometimes used in South Texas. Neither of these pesticides should be available for home use. More work is needed to make communities aware of the dangers of using these pesticides in the home.

2.4.2. Changes in Knowledge

Immediately following the health education module, participant knowledge scores increased almost 4 points out of 18. Six months later, some of the knowledge was lost, but there was a persistent improvement over the pre-test. It was promising to see that there were increases in the knowledge scores that persisted for at least six months. These results do suggest that one immediate post-test does not capture the prolonged result of a module. However, a longer-term assessment would allow researchers to evaluate whether the items remembered at six months will be lasting knowledge or whether knowledge continues to decrease over time.

On the individual test items, participants made significant improvement in 13 of the 18 items between the pre-test and six month post-test. For four of the five items in

which participants did not significantly improve, participants started with a high level of prior knowledge. One item that needs to be stressed in future work is the possibility of delayed health effects from pesticides. There is concern over storage of pesticides in these homes. These participants were aware that they should not reuse pesticide containers, and that they should place pesticides out of reach. However, while participants were aware that they needed to keep pesticides away from children, there was significant improvement regarding the participants' knowledge that it is a good idea to store pesticides in high cabinets. Another large improvement was made in recognizing why children are more vulnerable to pesticide exposures. The two items on which participants showed the greatest change was in knowing that they should use soap and cold water to remove pesticides from hands, and that Chinese chalk is illegal in the United States. This increased knowledge regarding Chinese chalk may lead to fewer purchases and applications of this pesticide.

2.4.3. Changes in Attitudes

After the module, participants were more likely to believe that pesticides can cause health problems for themselves and their children. Additionally, participants were more likely to think about pesticides. These attitudes follow changes in knowledge about the health effects of pesticides. A positive note on the attitudes suggests that participants felt more in control over their exposures to pesticides after the module. While the participants may be thinking more often about the problems pesticides may cause, a greater number also thought they could avoid these problems.

2.4.4. Changes in Behavior

Significant changes were seen following the module in behavior relating to hand washing, use of cold water to wash hands, and glove use. There were significant improvements relating to the use of cold water and gloves on the knowledge assessment as well. This suggests that participants are more aware that pesticides be absorbed through the skin. Participants reported being more likely to store pesticides out of the reach of children, and being less likely to use unmarked containers for pesticide storage. These behaviors should decrease the likelihood of accidental pesticide poisonings. Additionally, after the training, many more participants reported keeping emergency numbers and poison control center numbers close to the phone. A prior study of primarily Spanish speaking families in the Texas border area found the families were less likely to have emergency and Poison Control Center numbers close to the phone, and were less likely to use them compared to their English-speaking counterparts (87). Belson and colleagues proposed that pesticide education and outreach in these communities was needed to emphasize the use of Poison Control Centers (87). Use of Poison Control Centers may decrease pesticide poisoning effects and subsequent health care visits and costs. Quick access to emergency phone numbers is crucial if a young child accesses pesticides, bleach, or other similar hazards in the home. Fewer participants reported standing moisture in the home which attracts pests. In addition, after the module, 100% of the participants reported reading instructions on the pesticides labels. Many pesticides have Spanish language labels, improving their accessibility this audience. This greater attention to reading the label is particularly interesting given the

paucity of participants who reported feeling comfortable reading labels in English in the pesticide use-related conditions questionnaire.

2.4.5. Sustainability of the Information

Trainings of the type done in this study are costly and time consuming. In order to make the information more sustainable, researchers or programs may deliver this training to *promotoras* so that they can, in turn, deliver this training to parents in the community. In Texas, community health workers or promotoras can be certified if they have a required Department of State Health Services (DSHS) approved 160 hours of applicable training, or have a verified 1000 hours of community health work in the six years prior to application for certification (121). This is a two year certification, with renewal contingent upon an additional 20 hours, in those two years, of relevant continuing education (121).

2.4.6. Limitations

The generalizability of the study is limited by the characteristics of the participants in the study area, who may not be representative of all low-income residents or residents of Webb County. There may be self-selection of participants, in which the results will be positively biased. However, it was not feasible to control recruitment or randomly select in this study, due to monetary and time constraints. To limit the effects of self-selection, recruitment was as broad as possible under the eligibility criteria. Results may have been subject to recall and self-reporting bias. Participants may have

reported answers to the behavior and attitudes assessment questions based on what they thought researchers anticipated from the education module. This may have potentially biased results away from the null, but it was not feasible in the scope of this project for researchers to measure behaviors in a more direct fashion.

Prior to future studies with this module, the assessments and module should be updated to reflect the level of knowledge seen in the participants. For certain questions, a high percentage of the participants knew the correct answer before the module. Some content of the module could be changed to focus more on topics of which the participants were less aware. The knowledge assessment should also be updated to reflect changes in the content of the module. More questions should be added to the knowledge assessment to assure a spread of scores and pinpoint areas in which participants do not score well.

2.4.7. Summary

Spanish language labels need to be included on all pesticides, to encourage appropriate use. This study assessed knowledge, attitudes, and behaviors six months after a health education intervention. Longer-term retention of knowledge should be assessed in future studies, with additional post-tests at a year or longer time periods. Although this study did not have randomized participant selection, a similar intervention schedule could be used with randomized populations. Based on the results of this study, future pesticide education should focus on avoiding illegal and unmarked pesticides, and explaining that pesticides can have lasting and delayed effects. While more work needs

to be done in this field, the results of this study suggest that pesticide health education can create a persistent improvement in knowledge, attitudes, and behavior.

3. COMPARISON OF ATTITUDES AND BEHAVIORS FOLLOWING A PESTICIDE-FOCUSED HOME SAFETY EDUCATION INTERVENTION IN TWO NON-FARMWORKER HISPANIC COMMUNITIES

3.1. Overview

Pesticides are widely used in the US for crop pest management, control of pests in the built environment, and vector-borne disease control. The two classes of insecticides most widely used in the US are organophospates (OPs) and pyrethroids (122). These two classes of insecticides are preferred to their historic counterparts, the organochlorines (OCs), because they rapidly degrade in sunlight and water, and do not bioaccumulate. However both pyrethroids and OPs have acute and chronic health effects. The acute effects of OP exposure are from neurotoxicity due to inhibition of acetylcholinesterase (63). While the acute effects of OP exposure are well known, chronic low-dose effects are less well understood. Chronic exposures to OPs have been linked to neurobehavioral deficits, Parkinsonism, IQ deficit, infertility, birth defects, childhood cancers, and possibly asthma (56, 57, 59, 68). Pyrethroids are less toxic than OPs; however, the pyrethroids; permethrin, tetramethrin, and bifenthrin, are classified as possible carcinogens by the EPA (60, 61, 123) . Acute exposures to pyrethroids have neurotoxic effects due to inhibition of calcium binding channels (60, 61). Pyrethroids may suppress the luteinizing hormone pulse, mimic estrogen and be potential endocrine disruptors (60, 118). Additionally, the health effects of mixtures of OPs alone or with pyrethroids are not well studied. Some OPs are known to potentiate the toxicity of

certain pyrethroids (60). Much more work is needed to understand the potential health effects of mixtures of pesticides.

Children may have increased pesticide exposures due to the fact that they have higher per unit body weight food intake, water consumption, and respiration than adults. Additionally, children may have increased exposures from their crawling and mouthing behaviors. Children are more vulnerable to the health effects of pesticides, because they have lower levels of the OP detoxifying enzyme paraoxonase-1 (PON1), have increased absorption through the gastrointestinal and respiratory tracts, and have decreased rates of renal tubular secretion compared to adults (79-81). Further, children have more future years than adults, allowing more time for chronic diseases to develop.

Several studies have found that among children, most non-dietary pesticide exposure transpires in the home (83, 84). Pyrethroids and OPs have low vapor pressures and other chemical properties that promote adherence to dust particles (85). Indoor pesticide residues may persist because of the lack of heat, rain, and sunlight that degrade pesticides (84). Children of crawling age may consume as much as 10 grams of dust and soil per day (86). It is possible that limiting indoor pesticide exposures and use could have a significant impact on children's current and future health. There are also studies that suggest that pesticide exposures in urban settings may be different from those in the more studied agricultural and rural settings (88, 124).

Researchers have observed improper use of pesticides in homes in Webb County on the Texas-Mexico border, such as use of illegal pesticides, improper pesticide storage, and inappropriate pesticide usage (53). Additionally, concerns were raised by

promotoras about household pesticide use in San Antonio (52). San Antonio, located in South-central Texas, is the seventh most populous city in the U.S. and is the fastest growing major city. In this study, a pesticide-focused home safety health education intervention was delivered to families with young children in Webb County in predominantly rural areas, and the more urban neighborhoods of San Antonio. The purpose of this study is to compare attitudes and behaviors between two low-income Hispanic communities, one more rural and the other urban, before and after the delivery of the pesticide-focused home safety education intervention.

3.2 Methods

Specific pesticide education module topics were determined by review of pesticide use practices in South Texas. Bilingual research personnel including *promotoras* reviewed and translated the module and all assessments into culturally appropriate Spanish. The same module and assessments were used in both communities.

3.2.1. Pesticide-Focused Home Safety Education Module and Assessment

This environmental health education module focuses on pesticides, yet it includes other home safety topics. Pesticide-related topics include proper storage and handling of pesticides, the need to read pesticide labels for directions for use, illegal pesticides (what illegal pesticides are, how to recognize legal pesticides, and why illegal pesticides may be dangerous), and pesticide-related health concerns. Additionally the module covers some basic methods to limit pests infestations in homes, such as eliminating standing

water, limiting clutter, and keeping food in sealed containers when possible. The module explains why children are more vulnerable to dangers in the home. Physical, chemical, and electrical dangers are described. The electrical dangers section includes the need to avoid the use of damaged cords, and the hazards of electrical sockets. The physical dangers section covers slip and trip hazards, as well as, potential causes of burning. There is also a discussion of the potential causes and safe use of household cleaners.

The four assessments were a demographic survey, a survey of household pesticide use and use-related conditions, an assessment of attitudes and behaviors, and an assessment of knowledge. The pesticide use and use-related conditions survey collected information on pesticide use, types of pests, housing conditions, and pets. The knowledge, attitudes and behaviors assessments reflected topics covered in the module. These assessments are included in Appendix I.

3.2.2. Promotora Training

The *promotoras* who delivered the pesticide education module in Webb County had been working as lay health educators in this location for over seven years at the start of this study. The San Antonio *promotoras* lived in the community and had prior experience as lay health educators in this location. The *promotoras* were trained in the delivery of this module, and subsequently took the four assessments (knowledge, attitudes, behaviors, and demographics) that were to be delivered to the study participants. This both familiarized the *promotoras* with the assessments and allowed

researchers to assess any gaps in *promotora* knowledge of the module. Additionally, each of the promotoras delivered the module to researchers before they trained community members.

3.2.3. Participant Eligibility, Recruitment, and Characteristics

Eligible participants were at least 18 years of age and had at least one child between the ages of six-months and 5 years residing with them. Children aged six-months to five years were considered most at risk for increased pesticide exposure. Participants lived in either the Kelly Air Force Base (KAFB) area of San Antonio or in Webb County. *Promotoras* conducted recruitment largely through their own personal social networks within these communities, and also recruited participants through flyers and door-to-door solicitation. The module and assessments took place during two home visits and required multiple hours to complete. Participants were reimbursed for their time with a $20 and $10 gift cards for completing the first and second visits, respectively.

The area near the former KAFB in San Antonio has a history of various environmental exposures including volatile organic compounds (50, 51). This area is an urban community, in the seventh most populous city in the US. Most (85%), of the Webb County participants lived in incorporated *colonias* that are functionally rural, because they lack typical urban services and conveniences (e.g. transportation services and larger grocery stores). The remaining fifteen percent of the Webb County participants were from low-income Hispanic areas in Laredo or from other rural

communities outside Laredo. The San Antonio and Webb County communities have different infrastructure and levels of urbanity, but share many characteristics.

Almost all of the participants, over 98% in both communities were female. Few of the participants were employed (22% in Webb County and 25% in San Antonio), yet most had a spouse that was employed (84% in Webb County and 88% in San Antonio). Most participants, 75% in Webb County and 82% in San Antonio, were from Mexico. Over 89% of participants in both communities preferred Spanish, and learned Spanish as their first language. In both communities, English was learned as a second language for about 35% of participants and about 56% of participants did not learn a second language in both communities. Slightly over half of the participants (65% in Webb County and 56% in San Antonio) were not high school graduates. Half of the participants in Webb County (49%) were married, but 85% of the San Antonio participants were married. Even when those in civil unions were counted as married, there were still significantly more married participants in San Antonio (data not shown). While over half of the participants in both communities had yearly household incomes under $17,000, there was a statistically significant difference between the incomes in the two communities. The percentage of participants with yearly incomes under $9000 was 55% in Webb County and 30% in San Antonio. Additionally, more participants in San Antonio had yearly incomes of over $17,000 (32%), than in Webb County (13%). The demographic characteristics for Webb County and San Antonio are summarized in Table 3.1.

Table 3.1. Demographic Characteristics of Study Participants in Both Communities

Characteristics		Webb County		San Antonio		p-value *
		N=146	(%)	N=54	(%)	
gender						
	female	142	(98.6)	53	(98.2)	0.81
	male	2	(1.4)	1	(1.8)	
country of origin						
	Mexico	108	(74.5)	44	(81.5)	0.31
	U. S.	34	(23.4)	9	(16.7)	
high school graduate						
	no	89	(64.5)	28	(56.0)	0.29
	yes	49	(35.5)	22	(44.0)	
employment						
	participant employed	32	(22.2)	13	(25.0)	0.34
	spouse employed	97	(84.4)	36	(87.8)	0.30
married						
	no	73	(50.7)	8	(14.8)	<0.0001
	yes	71	(49.3)	46	(85.2)	
preferred language						
	English	15	(10.3)	4	(7.4)	0.53
	Spanish	130	(89.7)	50	(92.6)	
first language learned						
	English	10	(6.9)	3	(5.7)	0.76
	Spanish	135	(93.1)	50	(99.3)	
second language learned						
	English	55	(38.2)	18	(36.7)	
	Spanish	8	(5.6)	3	(6.1)	0.89
	none	81	(56.2)	28	(57.1)	
yearly income category						
	< $8,999	67	(54.5)	14	(29.8)	
	$9,000 - $16,999	40	(32.5)	18	(38.3)	0.001
	>$17,000	16	(13.0)	15	(31.9)	

* Wilcoxon rank sum test at the 95% significance level

3.2.4. Intervention Delivery

Promotoras met with individuals in their homes for two separate visits. The first home visit consisted of the consent process, four pre-intervention assessments (a demographic survey, a knowledge assessment, an attitudes assessment, and a behaviors assessment), the delivery of the pesticide education module, and two post-intervention tests (the knowledge assessment and the attitudes assessment were repeated). The second home visit took place approximately six months after the first home visit. This second visit consisted of three post-tests: the knowledge assessment, the attitudes assessment, and the behaviors assessment.

3.2.5. Data Analysis

A summed knowledge score was created for each participant's pre- and post-intervention knowledge assessment scores. Paired t-tests were used to compare the summed knowledge scores. Complete cases were used in this analysis. Only three participants in San Antonio completed the knowledge pre-test, thus this pre-test is not included in the analysis.

Differences between communities in demographics and pesticide use-related behaviors were assessed by Wilcoxon rank-sum tests. Changes in attitudes and behaviors within the study communities were assessed using McNemar's chi square for binary variables and Wilcoxon's sign rank test for categorical variables, to account for the paired nature of the data. Due to the large number of significance tests, Bonferroni adjustments were made to the paired t-tests and McNemar's chi square tests. The data

were maintained in Microsoft Access 2010 (Microsoft Office version 2010, Microsoft Corp., Seattle, Washington) and all analysis and cleaning was completed using Stata/IC 11.0 (Stata software, version 11.0, Stata Corp., College Station, Texas).

3.2.6. Permission for Human Subjects Research

This project was approved under UTHSCSA IRB Protocol # HSC20100383E, and Texas A&M University IRB Protocol # 2009-0892.

3.3. Results

3.3.1. Pesticide Use-Related Conditions

A summary of conditions related to pesticide use may be seen in Table 3.2. More participants in San Antonio (85%) lived in single-family detached homes than in Webb County (59%). Additionally, fewer participants in San Antonio (11%) lived in a single-family connected home, than in Webb County (21%). While no participants in San Antonio lived in mobile/trailer homes, 12% of the Webb County participants lived in mobile/trailer homes. All of the San Antonio participants had local trash pick-up, but only 89% of Webb County participants received this service. In San Antonio most (77%) participants' trash was picked up once per week, while 94% of participants in Webb County had trash pick-up more than once per week. Only 66% of Webb County participants had air-conditioning, while 92% of San Antonio participants had air-

Table 3.2. Characteristics of Pesticide-use Related Conditions in Participant Homes

Description	Webb County		San Antonio		P-value †
	N=144*	(%)	N=54*	(%)	
Type of home					
single family detached	86	(59.3)	45	(84.9)	<0.001
single family connected	30	(20.7)	6	(11.3)	
Multi-family home	11	(7.6)	2	(3.8)	
trailer/mobile	17	(11.7)	0	(0)	
Garbage disposal					
local pick-up	129	(89.0)	54	(100)	0.01
burn	1	(0.7)	0	(0)	
Garbage collection					
less than one week between pick-up	136	(93.8)	10	(19.2)	<0.001
once per week	2	(1.4)	40	(76.9)	
more than one week between pick-up	5	(3.5)	2	(3.9)	
Water					
home has running water	137	(95.8)	53	(100)	0.13
leaky or dripping faucet	17	(11.9)	6	(11.8)	0.98
Air conditioning					
have A/C	94	(65.7)	44	(91.7)	<0.001
Window screens					
no windows have screens	28	(19.3)	9	(16.7)	0.44
half or less of the windows have screens	24	(16.6)	9	(16.7)	
more than half the windows have screens	18	(12.4)	4	(7.4)	
all windows have screens	75	(51.7)	32	(59.3)	
Efficacy:					
window screens are effective	125	(86.8)	41	(77.4)	0.11
Pest problems					
pest problems in last six-months	56	(38.9)	39	(72.2)	<0.001
ants	94	(65.3)	29	(56.9)	0.29
roaches	80	(55.6)	31	(62.0)	0.43
fleas	40	(27.8)	17	(34.7)	0.36
wasps	57	(39.6)	17	(35.4)	0.61
rats or other rodents	34	(23.6)	14	(29.2)	0.44
Pesticide home use					
used in home in last six-months	98	(68.1)	39	(75.0)	0.35
professional pesticide application	22	(15.3)	9	(17.0)	0.77
continuing pest problems	90	(62.5)	24	(46.2)	0.04
plan to use something else for pest control	88	(61.1)	16	(30.8)	0.85
Pets					
have indoor pets	27	(18.8)	5	(9.3)	0.11
use flea/tick control	19	(13.2)	9	(31.0)	<0.001
Pesticide labels					
understand English labels	82	(56.9)	32	(64.0)	0.38
understand Spanish labels	136	(94.4)	51	(96.2)	0.61
Have you ever used:					
airplane powder (methyl parathion)	9	(6.3)	1	(1.9)	0.21
DDT	9	(6.3)	1	(1.9)	0.21
Chinese or miraculous chalk	37	(25.7)	17	(31.5)	0.42

*Not all participants answered all questions. This assessment was given before the intervention.
† Wilcoxon rank sum test at the 95% significance level

conditioning. All of the above differences between the two communities were statistically significant.

Slightly more than half of the participants in Webb County and San Antonio (52% and 59%, respectively) had screens over all of their windows. Most of the participants in San Antonio and Webb County (87% and 77%, respectively) with any screens on their windows felt that those screens were effective at keeping pests away. Most participants, in both Webb County and San Antonio, had running water in their homes (96% and 100%, respectively), and few participants had leaky or dripping faucets (12% in both Webb County and San Antonio). Some participants had indoor pets (19% in Webb County and 9% in San Antonio). None of these differences were significant.

On a percentage basis, more participants in San Antonio than in Webb County (31% and 13%, respectively) used flea and tick control for their pets. Similarly, more participants in San Antonio than in Webb County (72% and 39%, respectively) reported pest problems in the six months prior to the intervention. Both of these community differences were significant. A significant difference was also reported in continuing pest problems; 62% of Webb County participants compared to 46% of San Antonio participants reported continuing pest problems. There were no significant differences regarding types of pests reported, or in reported home pesticide use. More than half of the participants in both communities reported problems with ants and roaches. Other pests reported in both communities were fleas, wasps, and rodents. Less than 20% of Webb County participants reported concerns over bees, scorpions, centipedes, spiders, mosquitoes, frogs, lizards, and snakes when asked if they had other pest problems (data

not shown). San Antonio participants did not report other pests in the survey. Over half of the participants in both communities reported using pesticides in their homes within the six months prior to the intervention. Fewer than 20% of participants in both Webb County and in San Antonio reported using a professional exterminator. Only 31% of San Antonio participants, contrasted with 61% of Webb County participants, reported they planned to use a method of pest control they had not previously tried.

More than half of the participants in both communities could read pesticide labels in English, and almost all of the participants could read pesticide labels in Spanish. Less than 10% of participants from either community (6% in Webb County and 2% in San Antonio) reported ever using airplane powder (methyl parathion) or DDT. Over a quarter of participants in both locations reported ever using Chinese chalk. Chinese chalk is a pyrethroid insecticide chalk of variable composition imported from China that is not approved by the U.S. EPA and not legal for sale in the U.S.

3.3.2. Knowledge Scores

The mean summed knowledge scores for the two study communities are summarized in Table 3.3. In Webb County, the mean summed knowledge pre-test score was 13.68 (98.33% CI: 13.24, 14.13). In San Antonio, pre-tests were not given to more than three participants, so there is not a mean score to report. The summed knowledge scores for the knowledge assessment immediately following the module were 17.48 (98.33% CI: 17.33, 17.62) in Webb County and 17.04 (98.33% CI: 16.55, 17.44) in San Antonio. There was not a statistically significant difference between the immediate

post-test group means for Webb County and San Antonio. Similarly, the summed knowledge scores for the knowledge assessment six months after the module were 15.92 (98.33% CI: 15.58, 16.25) in Webb County and 15.36 (98.33% CI: 14.90, 15.82) in San Antonio. These six month post-test confidence intervals also overlapped; there was not a statistically significant difference between the means of the two communities' six-month post-tests.

3.3.3. Attitudinal Questions

Participant responses to attitudinal home safety questions are summarized in Table 3.4. On the pre-test, the percentage of participants that thought pesticides could cause health problems in Webb County (89%) was significantly larger than in San Antonio (83%). However, this changed on the six-month post-test, which showed no significant difference in this question (97% of participants in Webb County and 85% in San Antonio that thought pesticides could cause pest problems). Between the pre-test and six-month post-test, the percent of participants reporting that pesticides could cause health problems significantly increased in Webb County, but not in San Antonio. On the pre-test, about forty percent of participants in both communities reported that in the last month that they had never thought about the health effects of pesticides; however, on the six month post-test, fewer (25% in San Antonio and 17% in Webb County) participants reported that in the last month that they had never thought about the health effects of pesticides. The decrease in the percentage of participants reporting that they had never

Table 3.3. Comparison of Summed Knowledge Scores in Webb County and San Antonio

Test	Webb County		San Antonio		P-Value*
	N	***Mean with 98.33% CI***	***N***	***Mean with 98.33% CI***	
Pre-test†	129	13.68 (13.24, 14.13)	-	-	-
Immediate post-test	132	17.48 (17.33, 17.62)	46	17.04 (16.65, 17.44)	0.99
Six month post-test	139	15.92 (15.58, 16.25)	39	15.36 (14.90, 15.82)	0.99

*T-test comparison of group means at the 98.33% significance level

† The knowledge pre-test was given to less than 10 percent of the participants in San Antonio and cannot be compared for this analysis

Table 3.4. Changes in Participant Responses in San Antonio to Attitudinal Home Safety Questions

Question	Response	Pre-test		Six-Month Post-test		P-value*
		N†	(%)	N†	(%)	
Do you think pesticides can cause health problems?	yes	45	(83.3) ‡	45	(84.9)	0.10
How often in the past month have you thought about health effects of pesticides?	never	22	(40.7)	13	(24.5)	0.44
Have you ever become sick from being around pesticides?	yes	7	(13.0) ‡	3	(5.7)	0.36
Do you believe your past or current use of pesticides will affect your future health?	yes	25	(46.3)	33	(62.3)	0.09
Do you believe that pesticides can affect the health of children?	yes	45	(83.3)	46	(86.8)	0.52
How much control do you feel you have over avoiding negative effects of pesticides?	some/a lot	36	(66.7)	44	(83.0)	0.02
How much control do you feel you have over the amount of pesticides you are exposed to?	some/a lot	36	(66.7) ‡	43	(81.1)	0.57

†There were 51 participants in San Antonio, but not all participants answered all question
* Wilcoxon sign rank test at the 95% significance level for difference between pre- and six-month post-test within San Antonio
‡ Statistically significant difference in scores between San Antonio and Webb County at one time, p-value <0.05 with Wilcoxon rank sum test at the 95% significance level, Webb County data can be found in Table 2.5 in Chapter 2.

thought about the health effects of pesticides in the last month was statistically significant in Webb County, but not in San Antonio.

In Webb County a significant increase was seen between the pre- and six-month post-test in the percent of participants who believed that their past or current use of pesticides would affect their health (64% and 75%, respectively). However, there were no significant differences between Webb County and San Antonio in the percentage of participants who believed that their past or current use of pesticides would affect their health (64% and 46%, respectively) for Webb County and San Antonio on the pre-test and (75% and 62%, respectively) on the six-month post-test. The number of participants in Webb County who believed that pesticides would affect children's health decreased significantly from the pre-test to the six-month post-test (137 and 129, respectively). In San Antonio, there was no significant change between the pre-test and six-month post-test in the percent of participants who believed that pesticides could affect children's health. Between Webb County and San Antonio, there was no significant difference in participants who believed that pesticides would affect children's health on the pre-test (95% and 83%, respectively) or six-month post-test (83% and 87%, respectively).

On the pre-test, there was a significant difference between San Antonio and Webb County (67% and 58%, respectively) with the percent of participants reporting that they felt they had some or a lot of control over the amount of pesticides that they were exposed to. However, on the six-month post-test, there was no significant difference between San Antonio (81%) and Webb County (75%) in the percentage of participants reporting that they felt they had some or a lot of control over the amount of

pesticides to which they are exposed. In Webb County, there was a significant difference in the percent of participants reporting that they felt between the pre- and six-month post-tests (58% and 75%, respectively) they had some or a lot of control over their pesticide exposure, in contrast, there was no significant difference in San Antonio in this attitude between the pre- and post-test (67% and 81%, respectively). Between the pre- and six-month post- test, there was a significant increase in both Webb County (63% and 77%, respectively) and San Antonio (67% and 83, respectively) in the percentage of participants who reported feeling that they had some or a lot of control over the negative effects of pesticides. There was no significant difference between Webb County and San Antonio in the percent of participants who reported feeling that they had some or a lot of control over the negative effects of pesticides, on either the pre-test (63% and 77%, respectively), or six-month post-test (77% and 83%, respectively).

3.3.4. Changes in Behavior–Based Questions

The results from the behavior assessment are summarized in Table 3.5. On the pre-tests, there were a significantly higher percentage of participants in San Antonio than in Webb County (83% and 72%, respectively) that reported always washing their hands with cold water after using pesticides. No significant difference in participants who reported this hand washing behavior was found in the six-month post-tests between Webb County and San Antonio (90% and 85%, respectively). In Webb County, there was a significant increase in the percentage of participants reporting always washing their hands with cold water after using pesticides between the pre- and six-month post-

tests (72% and 90%, respectively); conversely, in San Antonio, there was no significant change in percentage of participants reporting this behavior between the pre- and six-month post-tests (83% and 85%, respectively). Additionally, there were no significant differences in the percentage of participants reporting it was necessary to wash their hands after applying pesticides between San Antonio and Webb County on either the pre-test or six-month post-tests. In San Antonio, there was not a significant difference between the pre-and six-month post-test (96% and 96%, respectively) in the percentage of participants who reported it was necessary to wash their hands after applying pesticides in San Antonio; however, there was a significant difference in the percentage of participants reporting this behavior in Webb County between the pre-and six-month post-test (94% and 99%, respectively).

Between the pre- and six-month post-test, both communities also had a significant increase in the percentage of participants reporting always using gloves when applying pesticides (37% to 47% in San Antonio and 45% to 74% in Webb County, respectively). There was not a significant difference between the percentages of San Antonio and Webb County participants reporting always using gloves when applying pesticides on the pre-test (37% and 45%, respectively), there was a significant difference between the percentages of San Antonio and Webb County participants reporting this behavior on the six-month post-test (47% and 74%, respectively).

Table 3.5. Changes in San Antonio Participant Response to Behavior-based Home Safety Questions

Question	Desired response	Pre-test		six-month Post-test		P-Value ‡
		N†	(%)	N†	(%)	
I wash my hands with cold water after using pesticides	always	45	(83.3)	45	(84.9)	0.79
It is necessary to wash my hands after applying pesticides	always	52	(96.3)	51	(96.2)	1.00
I keep pesticides out of the reach of my children	always	50	(92.6)	49	(92.5)	0.95
I use electrical cords which are damaged	never	51	(94.4) *	43	(81.1)	0.008
I read the instructions on the label before applying pesticides	always	39	(72.2)	43	(81.1)	0.59
I use gloves when applying pesticides	always	20	(37.0)	25	(47.2) *	0.02
I have emergency phone numbers next to the phone in case of a poisoning	always	24	(44.4)	31	(58.5) *	0.21
I keep pesticides in unmarked containers	never	44	(81.5) *	44	(83.0)	0.75
I have areas of standing water or moisture around my home	never	43	(79.6)	45	(84.9)	0.83

†There were 51 participants in San Antonio, but not all participants answered all question

‡ Wilcoxon sign rank test at the 95% significance level for difference between pre- and six-month post-test within San Antonio

*Statistically significant difference in scores between San Antonio and Webb County, p-value <0.05 with Wilcoxon rank sum test at the 95% significance level, Webb County data can be found in Table 2.6 in Chapter 2.

There was not a significant difference between Webb County and San Antonio in the percentages of participants who reported never keeping pesticides in unmarked containers on the pre-test (69% and 82%, respectively) or on the six-month post-tests (86% and 83%, respectively). In San Antonio there was also no significant difference from the pre-test to six-month post-test in (82% to 83%, respectively) in the percentage of participants who never stored pesticides in unmarked containers; however, there was a significant increase in the percent of participants who reported never storing pesticides this way in Webb County (69% to 86%, respectively) between the pre- and six-month post-test.

A significant difference was found between the percentage of participants in Webb County (84%) and San Antonio (94%) who reported never using damaged electrical cords on the pre-test, but not on the six-month post- test (90% and 81%, respectively). Both communities had statistically significant changes in participants who reported never using damaged electrical cords between the pre- and six-month post-test, yet there was an increase in Webb County (84% to 90%, respectively) and a decrease in San Antonio (94% to 81%, respectively).

On the pre-test, the two communities had the same percentage (44%) who reported always having emergency numbers next to the phone in case of an emergency. On the six-month post-test, there was a significant difference between San Antonio (82%) and Webb County (59%) in the percentage of participants reporting always having emergency numbers next to the phone, in case of an emergency. There was a significant increase in the percentage of participants in Webb County reporting this

behavior from the pre-test to the six-month post-test (44% to 82%, respectively); there was not a significant increase in participants in San Antonio reporting this behavior from the pre-test to the six-month post-test (44% to 59%, respectively).

3.4. Discussion

3.4.1. Demographics, Attitudes, and Behaviors

The demographics of the participants from the two study communities are very similar in gender, country of origin, education status, employment status of self and spouse, and language. Many more participants were married in San Antonio than in Webb County, even when civil union/*union libre* was included as married. More participants in San Antonio (32%) were in the over $17,000 annual household income bracket, than in Webb County (59%). Additionally, fewer participants in San Antonio (30%) were in the under $9,000 annual household income bracket, than in Webb County (55%). While San Antonio participants were more likely to have higher household incomes, they did not differ from Webb County in country of origin, language or education, which tend to be predictors of Mexican-American income (31). This income difference between the communities may be due to increased base income in the more urban San Antonio environment. Regardless of the income level, at least 68% of participants in San Antonio and 87% of participants in Webb County are living below the 2012 U.S. poverty level of $18,287 for a family of three (125).

While 92% of participants in San Antonio had air-conditioning, only 66% of Webb County participants did. With the high summer temperatures in South Texas, lack of air-conditioning means that windows will be open for ventilation for long periods of time. Additionally, only slightly more than half (52%) of participants in Webb County have window screens on all residence windows. The participants reporting having screens on all windows are highly correlated with those that have air-conditioning (data not shown). Many Webb County participants keep their windows open for large portions of the year. Without window screens, these open windows may allow pests to enter a residence for food and shelter. *Promotoras* in San Antonio were able to connect participants with weatherization programs. However, in Webb County, distance, lack of transportation, and fewer programs, made it more difficult to connect to similar programs (53). Additionally, the cost of meeting the standards for weatherization programs may be too high for many people in either community (52).

Less than 20% of participants in either community reported having indoor pets, and 31% of participants in San Antonio reported using flea/tick control. Depending on the type of flea/tick control used, these families may be consistently exposed to pesticides when interacting with their pets. San Antonio *promotoras* indicated that flea and tick collars were a common form of pest control used on pets (126). These collars are less expensive than spot treatments, but the insecticides embedded in and released from these collars may cause harmful exposures in young children. More tailored information on flea and tick control should be included in pesticide education in this

community. In both communities, there are feral dogs that may add to the pest problem. Both communities would benefit from low cost or volunteer veterinary programs.

Despite only 39% of Webb County participants reporting pest problems in the last six-months, 68% reported using pesticides in their homes in the same time period. In San Antonio, 72% of participants reported pest problems in the last six months, and 75% reported home pesticide use in that same time period. Webb County residents may not consider the need for household pesticides indicative of a pest problem, or may be hesitant to report a pest problem. Participants in the two study communities reported similar pest, and household pesticide use. These two communities are in the same general region of south Texas and have a similar climate and similar pests (Table 3.2). Over 60% of participants in Webb County reported continuing pest problems, as did over 45% of participants in San Antonio. These ongoing pest control problems may lead to more pesticide use, and possibly to mixtures of pesticides in the home.

Only 57% of Webb County and 64% of San Antonio participants are able to understand pesticide labels in English, while over 90% of participants in both communities can understand pesticide labels written in Spanish. This makes Spanish-language labels for pesticides very important. Some pesticide brands, such as Raid, include Spanish-language labels on insecticides sold in South Texas. Raid is commonly used among our participants (data not shown), possibly due to marketing and labeling done in Spanish.

About six percent of our participants in Webb County and two percent of the participants in San Antonio had used methyl parathion and DDT. Prior to this study,

concerns over use of methyl parathion, or airplane powder, were raised when researchers were able to purchase this insecticide in unlabeled plastic baggies. At least 25% of participants in both Webb County and San Antonio had used Chinese chalk (also called insecticide chalk or miraculous chalk). Chinese chalk is a pyrethroid insecticide of variable composition that is imported from China and is not approved by the U.S. EPA for use in the U.S. A recent study reported insecticide chalk accidental ingestions in South Texas (127). This study suggested that Chinese chalk should be discussed in future pesticide-related health education in South Texas.

In both San Antonio and Webb County, there was a statistically significant increase between the pre-test and the six month post-test in participants feeling that they had some or a lot of control over avoiding the negative effects of pesticides. This suggests that the pesticide module may have been effective in empowering participants to decrease their pesticide exposures. Significantly more participants in than in San thought pesticides could cause health problems, before and after the module. There were also significant changes, between the pre and six month post-test in Webb County, but not in San Antonio, in participants thinking about the health effects of pesticides, believing current use of pesticides can affect future health, believing pesticides can affect the health of children, and feeling that they have some/a lot of control over the amount of pesticides to which they are exposed. One reason changes in attitudes were seen in Webb County, but not in San Antonio, may be the smaller sample size in San Antonio, limiting the detectable effect size.

In both San Antonio and Webb County, there was a statistically significant increase between the pre- and post-test the percentage of participants reporting pesticides could cause health problems. This suggests that the module was effective in communicating the need to protect skin from pesticides. There was also a significant difference between the two communities in the percentage of participants reporting pesticides could cause health problems on the post-test. Significantly more participants in Webb County (74%) than in San Antonio (47%) reported using gloves when applying pesticides on the six month post-test. Perhaps more emphasis was placed on hand washing than on glove use in the delivery of the module in San Antonio.

More participants in San Antonio than in Webb County reported never using damaged electrical cords on the pre-test. On the six month post-test there was a statistically significant increase in participants reporting never using damaged electrical cords in Webb County, yet there was a significant decrease in participants reporting this behavior in San Antonio. The module covered the dangers of damaged electrical cords, and this message appears to have been effective in Webb County. It is possible this information was de-emphasized when the module was delivered in San Antonio, due to focus on pesticides. The change in use of damaged electrical cords in San Antonio may also be an artifact of the small sample size.

While there was an increase between the pre- and post-tests in both communities in the percentage of participants who reported that they keep emergency phone numbers next to the phone, this increase was only statistically significant in Webb County. There was a significant difference in the percentage of participants who reported keeping

emergency phone numbers next to their phones, between the two study communities. The posting of emergency numbers next to phones was more important when every home had a land-line. Now, there are many people who keep cell phones and do not maintain a land-line phone. The non-significant finding in San Antonio may indicate that this question and information should be changed. However, a past study reported than Spanish speaking families were less likely to use poison control centers and that there was a need to make Spanish speakers in South Texas more aware of Poison Control Centers (87). Use of Poison Control Centers may cut down on unnecessary medical visits and medical care costs. Future studies should include adding emergency phone numbers to the participants' cell phones. This would also be a behavior that *promotoras* could confirm and quantify.

On the pre-test, significantly more participants in San Antonio than in Webb County reported never keeping pesticides in unlabeled containers. Repurposing containers that once contained pesticides may lead to accidental poisonings. Additionally, unlabeled containers may be confused with drink or food containers, potentially leading to accidental ingestion of pesticides. There was a significant increase between the pre- and post-tests, in participants in Webb County reporting that they never keep pesticides in unlabeled containers. There was not an increase in participants reporting this behavior in San Antonio, however; significantly fewer participants in San Antonio reported keeping pesticides in unlabeled containers on the pre-test.

3.4.2. Knowledge Assessment Instrument

The immediate post-test and six month post-test mean knowledge scores were similar and not statistically different between San Antonio and Webb County. The knowledge pre-tests were not given to most participants in San Antonio, preventing a discussion of changes in knowledge in this community. However, given that the post-tests knowledge scores were similar across communities, this data suggest that exposure to the survey instrument prior to the intervention did not bias the post-test results. Changes between the pre-test and post-tests in Webb County are then not due to pre-exposure to the survey instrument, but are instead due to the impact and retention of the intervention. The Webb County knowledge scores were discussed at greater length in Chapter 2.

3.4.3. Limitations

There were fewer participants in San Antonio than in Webb County, as the San Antonio study was a preliminary study. The smaller sample size in San Antonio led to the inability to detect the same effect sizes as could be found in the Webb County data. This does bias the San Antonio results towards the null. Non-significant findings in the San Antonio data may not indicate a difference in the module delivery or community, but instead reflect this null bias.

While this is a comparison of two communities, there is no non-intervention comparison group. Differences between communities may be due to non-intervention communication and outreach. The participants were recruited through *promotora* social

networks, flyers, and door-to-door solicitation, and not randomly selected. While this recruitment strategy does cause self-selection, and potentially bias results away from the null, this recruitment strategy allows for recruitment of a specific population in a reasonably low cost, and timely fashion. Behaviors were self-reported, and may be subject to recall bias. Participants may have chosen answers that they thought were consistent with researcher anticipation. Although this could bias results away from the null, a more direct measure of behavior changes was outside the scope of this study.

3.4.4. Summary

Future studies should include a non-intervention comparison group, and maintain similar sample sizes in the different communities. The module and assessments should be updated with less emphasis in areas in which participants performed well, and more emphasis on lower performance areas. More emphasis should be given to future impacts of current pesticide use and use of illegal pesticides. Additionally, a new emphasis should be placed on emergency phone numbers placed near or programmed into phones. Phone stickers and fridge magnets of emergency phone numbers may not be as now that cell phones have replaced many land-lines. Policy makers and pesticide manufacturers should be aware of the need to include Spanish language labels on pesticides sold in South Texas.

4. A PRELIMINARY STUDY OF CHANGES IN KNOWLEDGE, ATTITUDES, AND BEHAVIORS FOLLOWING A HEALTHY BEHAVIORS INTERVENTION IN SAN ANTONIO, TX

4.1. Overview

Persons identifying as Latino/Hispanic are the largest minority group in the U.S. In Texas, 38.1 % of the population identifies as Hispanic/Latino in origin, compared to 16.7 % of the population of the United States (12). Latinos tend to self-identify as a member of their nuclear or extended family (25). For this reason, interventions targeted at autonomous individuals may be less successful than a message aimed at changing the family. Many Hispanics have a fatalistic health attitude, yet this attitude may be altered by making health into a familial concern rather than a personal one (26). Behavior change in Hispanic communities happens in a family context. The family is the primary social support, though this may change with very long term US residence (22). In traditional Hispanic communities, the wife-mother has the role of greatest significance to health interventions. The traditional gender norms and roles make her the leader for change within her family (27). She also has the most influence on the family's diet (28). This wife-mother should be the focus of health education interventions in Hispanic communities.

In the U.S., six out of every ten women is overweight or obese. These numbers rise to seven in ten for Mexican American women (91). An additional 13 % increase in obesity is seen in Mexican American women living below the poverty level (91). Many

different factors may contribute to this disparity, including cultural factors, environmental factors, social factors, health literacy, nutrition knowledge, decreased use of preventative services, and poorer overall health (92, 93). Family customs may also be a barrier to dietary change.

Promotoras are also called lay health advisors/educators (LHA), community health workers (CHW), natural helpers, and peer educators. The idea behind *promotoras* is based on the concept of spread of health information through informal and formal social networks (22). Because *promotoras* typically deliver the health intervention in person, there is less misunderstanding and increased acceptance of the message.

A randomized controlled trial evaluating *promotora*-led health education intervention reported a change in healthy behaviors and blood pressure (39). Several studies have been performed on *promotora* based interventions and nutrition. Faucher and Mobley saw increased weight loss in low income Mexican-American women that were involved in a *promotora*-led portion control intervention over a non-*promotora*-led comparison group (40). In a study by Elder et al., a *promotora* driven health education intervention on nutrition was associated with statistically significantly lower intake of fat and carbohydrates and higher intake of fiber, than was seen among individuals receiving tailored print materials alone, or stock print materials (16). A systematic review of overweight and obesity interventions in Hispanic children in the US concludes that interventions are more successful when: participants are at a higher risk, the intervention involves parents, interventions are based in theory, and interventions recruit older children (22). In addition, *promotora*-led interventions have impacts beyond print

material, even ones tailored to the community (22). A systematic review of LHA programs concluded that these programs "can achieve significant changes in a variety of health-related factors for Latino populations" (31).

The study community encompassed residents in the former Kelly Air Force Base (KAFB) area of San Antonio. Environmental contaminants have been documented in this region, such as, halogenated solvents organophosphate pesticides (50-52). Additionally, Hispanics in the zip codes neighboring the former KAFB have a higher incidence of hepatocellular carcinoma than Hispanics in Texas or other races living in the former KAFB area (48, 49). *Promotoras* in this community were concerned about nutrition and physical activity as a modifiable way to improve the health of the individuals in this community.

4.2. Methods

4.2.1. *Promotora* Recruitment and Training

The Family Service Association of San Antonio, Texas, Inc. (FSA) is a private, non-sectarian, not-for-profit human service agency The FSA has a location called The Neighborhood Place, which is a social services mall placed in a former elementary school acquired from the school district. In addition to connecting families in this community with needed social services, at the time of this project, the FSA employed multiple *promotoras* for work on various health education projects in the local schools. Four of these *promotoras* were recruited for delivery of the nutrition module. These

women had prior experience in other projects and were extensively connected to the community.

Prior to recruitment and module delivery, the promotoras were trained on the module content, as well as management of health education research. Each *promotora* delivered the module to a researcher and responded to questions as part of their training. Each *promotora* also completed all of the assessments that were to be delivered to the participants, to familiarize them with the questionnaires and assess their knowledge gaps. The researchers worked with the *promotoras* to address any weaknesses or lack of knowledge regarding the module delivery and assessments. All the FSA *promotoras* completed the training satisfactorily.

4.2.2. Module Development

The topic and content of the module were guided by multiple discussions and reviews with the FSA's *promotoras* and community liaison. One *promotora* in particular had experience with changing her family's diet. She was able to share healthier versions of regional recipes that were included as handouts to participant families. These *promotoras* and another bilingual collaborator were involved in the translation of the modules, assessments and recipes into linguistically and culturally appropriate Spanish.

The module addressed topics including portion sizes, reading nutrition labels, food substitutions, recommended foods and beverages, weight loss, and physical activity. Assessments reflected the topics of the module. Many examples of serving sizes

and physical activity were added to the module. Additionally, examples of servings of fruit and vegetables given on the assessments were a half cup of sliced fruit or fruit juice, three-quarters of a cup of frozen vegetables, one small apple, one banana, ten baby carrots, or one ear of corn. On the assessments, a serving or glass of beverage was defined as eight ounces or once cup.

4.2.3. Participant Recruitment, Eligibility, and Characteristics

Participants were eligible for this study if: a) they were 18 years of age or older, b) they had at least one child that was 16 years of age or younger, and c) they lived in one of three zip codes (78207, 78237, or 78228) in San Antonio between January and September 2012. *Promotoras* recruited participants through flyers at local elementary schools and through their social networks in the community. Participants were compensated with a $20 grocery card for the first visit, and a $10 grocery card for the three month follow-up visit.

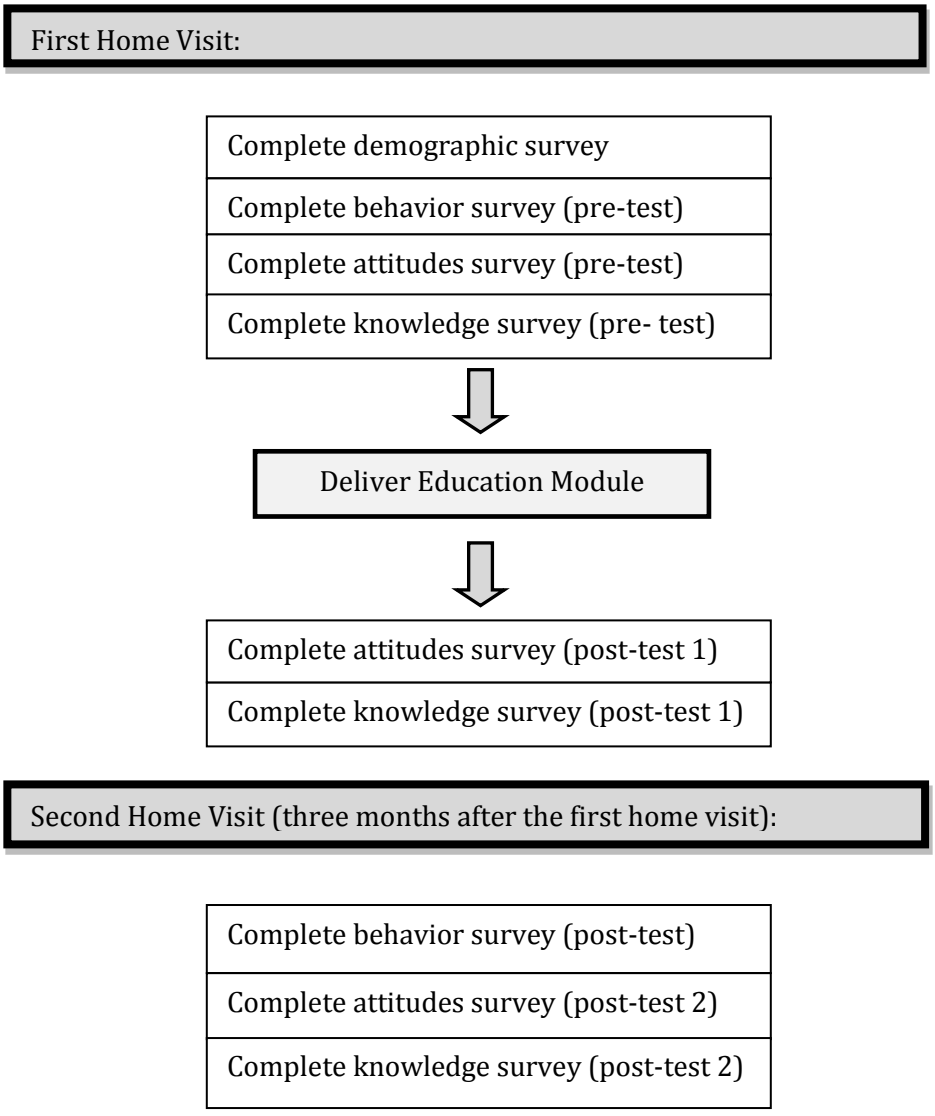
Table 4.1 is a summary of the demographic characteristics of the study participants. All of the respondents identified as female. Almost three-quarters (72.6 %) of the participants were from Mexico. A majority (60.4 %) of the participants were not high school graduates. Most (90.2 %) participants were married and preferred communication in Spanish. Spanish was the first language learned for 94.1 % of the participants. Over half of the participants (51.1 %) had not learned a second language. A little over a third (38.8 %) of the participants had a child 8 years or younger. An additional 38.8 % had a child between the ages of 9 and 12 years. Finally, less than a

Table 4.1. Demographic Characteristics of Study Participants

Characteristics		N=51*	(%)
Gender			
	Female	49	(100)
Country of origin			
	Mexico	37	(72.6)
	U. S.	11	(21.6)
High school graduate			
	no	29	(60.4)
	yes	19	(39.6)
Married			
	no	5	(9.8)
	yes	46	(90.2)
Preferred language			
	English	5	(9.8)
	Spanish	46	(90.2)
First language learned			
	English	3	(5.9)
	Spanish	48	(94.1)
Second language learned			
	English	19	(42.2)
	Spanish	3	(6.7)
	none	23	(51.1)
Children's ages			
	8 years or younger	19	(38.8)
	9-12 years	19	(38.8)
	13-16 years	11	(22.5)

*Not all respondents answered all questions

Figure 4.1. Healthy Behaviors Intervention Schedule



quarter (22.5 %) of the participants had a child between 13 and 16 years of age. While 51 participants were recruited and began the first home visit, one participant did not complete all of the assessments in the first home visit. All 50 of the participants who

completed all of the questionnaires and training during the first home visit also completed all of the follow-up questionnaires during the second home visit.

4.2.4. Intervention Schedule

The *promotoras* had two home visits with each participant. In the first visit, participants were taken through the informed consent process, given four pre-module assessments (a demographic questionnaire, a knowledge assessment, an attitudes assessment, and a behavior assessment). Following these four pre-tests, the healthy behaviors module was delivered. Participants were encouraged to discuss the information and ask questions throughout the module delivery. After completion of the module, each participant was given two post-tests (the knowledge assessment and the attitudes assessment). In the follow-up visit that took place three months after the first visit, participants were given three post-tests: the knowledge assessment, the attitudes assessment, and the behavior assessment. A brief outline of the process can be seen in Figure 4.1.

4.2.5. Data Analysis

A summed knowledge score was created by adding the total number correct on the knowledge test for each participant who completed the knowledge test. Participants who did not answer all knowledge questions were not included in the summed score analysis. To determine if there was a difference in the summed score means of the pre-test, immediate post-test, and three month post-test, paired t-tests were conducted.

To determine if there were changes in individual knowledge items, attitudes, or behaviors, McNemar chi square was employed on the binary response frequencies. When data did not meet the necessary assumptions for paired t-tests or McNemar chi square, the Wilcoxon sign rank test was employed. This analysis consisted of many tests of significance, thus a Bonferroni adjustment was applied to the significance tests. The more conservative Bonferroni corrections did not alter the significance of the data compared to a 95 % confidence limit. These statistical analyses were conducted with the use of STATA /IC 11.0 (Stata software, version 11.0, Stata Corp., College Station, Texas).

4.2.6. Permission for Human Subjects Research

This project was approved under Texas A&M University IRB Protocol # 2009-0892.

4.3. Results

4.3.1. Knowledge Scores

The maximum score for the knowledge test was 10. The mean participant summed score for the 38 people who completed all of the questions on the knowledge pre-test was 6.78 points (98.33% CI: 6.26, 7.29). The mean score for the immediate post-test, with 45 people completing the assessment, was 7.78 (98.33% CI: 7.39, 8.16) and for the three month post-test, with 41 people completing the assessment, was 7.32

(98.33% CI: 6.86, 7.77) (Figure 4.2). When only the 38 people who completed all three knowledge assessments were compared, the mean difference between the pre-test and immediate post-test was a score increase of 0.92 points (99.33% CI: 0.28, 1.56), corresponding to an almost ten percent increase in the knowledge score (Table 4.2). For the 41 participants who completed both the pre-test and 3 month post-test, there was a 0.54 point increase between the pre-test and three month post-test, however this change was not statistically significant. This corresponds to a five percent increase in knowledge score over the baseline knowledge, three months later.

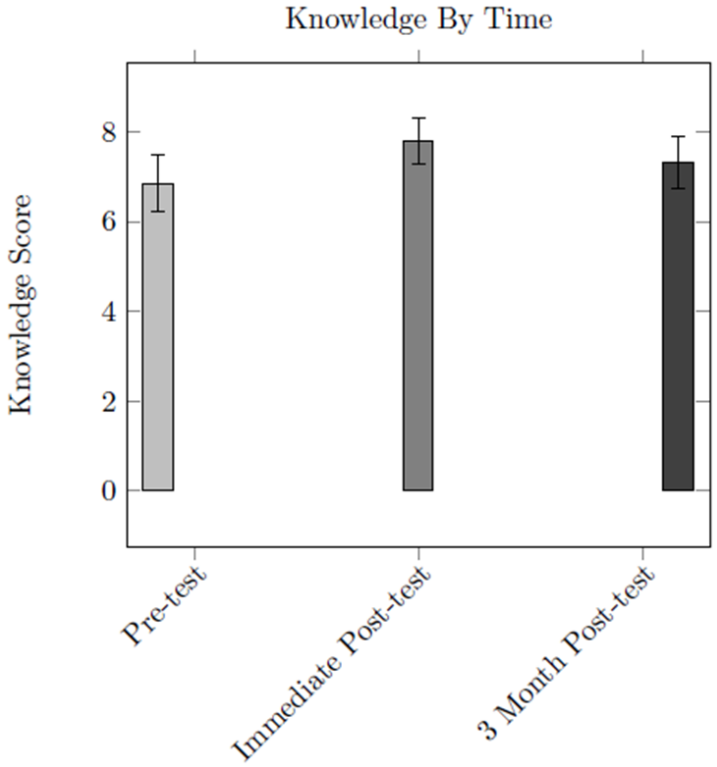
Participant performance on individual knowledge test items is summarized in Table 4.3. A large significant increase was seen in the percentage of participants answering that they should eat five or more servings of fruits and vegetables per day (23% on the pre-test vs. 40% on the three month post-test). In addition, significantly more participants answered that good nutrition is important because it prevents disease, it may prevent heart disease, type II diabetes, and obesity on the three month post-test (86%) than on the pre-test (71%). There was no statistically significant increase in knowledge between the pre-test and three month post-test on the remaining eight questions that addressed whole grains, reading nutrition labels, water, physical activity, washing fruits and vegetables, and specific nutrients.

Table 4.2. Mean Differences in Summed Knowledge Scores

Tests*	N	Mean score difference†	CI: 98.33%
Immediate post-test and pre-test	38	0.92	(0.28, 1.56)
3 month post-test and pre-test	41	0.54	(-0.21, 1.28)

*Only complete cases were used (all knowledge questions answered on both knowledge tests in the pair)
†Paired t-tests with Bonferroni adjustment

Figure 4.2. Mean Participant Performance on Knowledge Assessment



Error bars represent confidence intervals
The maximum score is 10
Pre-test mean was 6.87 (98.33% CI: 6.23, 7.51), with N=38
Immediate post-test mean was 7.79 (98.33% CI: 7.27, 8.30), with N=38
Three month post-test mean was 7.32 (98.33% CI: 6.75, 7.89), with N=41

Table 4.3. Correct Responses to Individual Knowledge Assessment Items on the Pre-test and the Three Month Post-test

Question	Pre-test N=51† (%)	3-month Post-test* N = 50† (%)	P-value
Good nutrition is important because *vitamins and minerals prevent diseases, it may prevent heart disease, type II diabetes, and obesity*	35 (71.4)	43 (86.0)	0.02 [a]
How many servings of fruits and vegetables should you eat per day? *– 5 or more*	12 (23.5)	20 (40.0)	0.03 [a]
At least how much of your grains should be whole grains? *½*	20 (41.7)	17 (35.4)	0.49 [a]
What is the best way to know if a product is healthy? *–read the nutrition label*	50 (98.0)	49 (98.0)	1.00 [b]
A balanced plate should be: *-½ fruits and vegetables, ¼ meats and proteins, and ¼ grains and potatoes*	29 (63.0)	25 (51.0)	0.25 [a]
When reading the nutrition label what items should you limit? *Fats, sugars, salt*	37 (78.7)	42 (84.0)	0.41 [a]
What types of meats are the most healthy to eat? *Lean (turkey, chicken, fish)*	44 (91.7)	48 (96.0)	0.16 [b]
What beverage should make up most of what you drink? *water*	46 (95.8)	50 (100)	0.16 [b]
Fruits and vegetables should be washed: *in cold running water*	36 (75.0)	43 (86.0)	0.13 [a]
How much physical activity do children need per day? *60 minutes*	16 (34.0)	23 (46.0)	0.13 [a]

* Post-tests were given three months after the Pesticide Health Education Module intervention

† Not all participants answered all questions

[a] McNemar's Chi Square (α= 99.38)

[b] Wilcoxon sign rank test

4.3.2. Attitudes Assessment

The changes in participant attitudes and responses to attitudinal questions are summarized in Table 4.4. There was a significant increase in the percentage of participants who were concerned with the growing obesity problem in the U.S. between the pre-test (88%) and the three month post-test (100%). Notably, when the results of the pre-test and the three month post-test were compared, there was a significant increase in participants agreeing that they had control over their child's eating habits (73% and 92%, respectively) and amount of physical activity (78% and 94%, respectively) . Beyond this, there was little or no change in many of the specific attitudes that were assessed. On both the pre-test and three month post-test, a high percentage of participants agreed with the statement that their health can be affected by eating habits (87% and 84%, respectively) and the statement that their health can be affected by physical activity (96% and 94%, respectively). Between the pre-test and three month post-test, non-significant improvements were seen in attitudes about health problems related to eating habits (73% and 80%, respectively), concern about the contents of packaged foods (75% and 80%, respectively), and concern about their child's level of physical activity (67% and 73%, respectively). No real improvement was seen in participant concern over their child's eating habits between the pre-test and the three month post-test.

On the immediate post-test 82% of participants were concerned about the amount of physical activity their child received (data not shown). This was significantly higher than the percent of participants who reported being concerned about this on either the

Table 4.4. Participants in Agreement or Strong Agreement with Attitudinal Phrases

Question	Pre-test N = 51† (%)	3-month Post-test* N = 51† (%)	P-value
Eating habits affect my health	42 (87.5)	42 (84.0)	1.00 [b]
Physical activity can have a positive effect on my health	49 (96.1)	47 (94.0)	0.99 [b]
I believe that health problems can be related to eating habits	37 (72.6)	41 (80.4)	0.29 [a]
I am concerned about the contents of packaged foods	38 (74.5)	41 (80.4)	0.47[a]
I am concerned about my child's eating habits	36 (70.6)	37 (72.6)	0.76 [a]
I am concerned about the growing problem of obesity in the U.S.	45 (88.2)	50 (100)	0.09 [b]
I am concerned about the amount of physical activity my child gets	34 (66.7)	37 (72.6)	0.41 [a]
I am capable of controlling my own weight	37 (72.6)	34 (66.7)	0.47 [a]
I have control over my child's eating habits	37 (72.6)	47 (92.2)	0.008 [a]
I have control over the amount of physical activity my child gets	40 (78.4)	48 (94.1)	0.02 [b]

* Post-tests were given six months after the Pesticide Health Education intervention
† Not all participants responded to all questions
a McNemar's Chi Square (α= 99.38)
b Wilcoxon sign rank test

pre-test or the three month post-test (67% and 73%, respectively). Additionally a significantly larger percentage of participants reported that they were capable of controlling their own weight one the immediate post-test (90%, data not shown) than on either the pre-test or three month post-test (73%, and 67%, respectively). While there was not a statistically significant increase in participants reporting that they hold control over either their children's eating habits, or amount of physical activity, between the pre-test (73% and 78%, respectively) and the immediate post-test (82% and 88%, respectively, data not shown), both attitudes significantly increased on the three month post-test (92% and 94%, respectively).

4.3.3. Behaviors Assessment

Participants were asked to report the behavior of themselves and their children. These reported behaviors are summarized in Table 4.5. There was a significant increase in participants reporting their child was drinking one or fewer glasses of soda per day, from 16% on the pre-test to 65% on the three month post-test. There was also a significant increase in the amount of milk the child drinks on a typical day, with 49% on the pre-test, and 62% on the post-test, reporting two or more glasses a day. There was no significant increase in the amount of water (24% and 35%, respectively), physical activity (73% and 69%, respectively), or number of servings of fruit and vegetables (76% and 75%, respectively) the child had on a typical day between the pre-test and three month post-test.

Table 4.5. Changes in Participant Response to Behavior-based Questions

Question	Response	Pre-test N =51[1] (%)	3-month Post-test* N = 51[1] (%)	P-Value
Child behaviors:				
How much water does your child drink on a typical day†	≥5 servings	12 (24.5)	18 (35.3)	0.08 [b]
How much soda does your child drink on a typical day†	≤1 serving	7 (15.6)	33 (64.7)	<0.0001 [b]
On average how much physical activity does your child get per day	≥ 30 min	36 (73.5)	35 (68.6)	0.59 [a]
How much milk does your child drink on a typical day†	≥2 servings	24 (49.0)	31 (62.0)	0.02 [b]
How many servings of fruit and vegetables does this child eat in a typical day‡	≥4 servings	37 (75.5)	38 (74.5)	0.76 [a]
Adult behaviors:				
How much water do you drink on a typical day†	≥5 servings	21 (42.0)	32 (62.8)	0.002 [b]
On average how much physical activity do you get per day	≥ 30 min	27 (55.1)	35 (68.6)	0.33 [b]
In the last 2 weeks, I have increased servings of fruits and vegetables	Yes	30 (60.0)	41(80.4)	0.09 [a]
In the last 2 weeks, I have replaced any beverages with water	Yes	30 (61.2)	36 (70.6)	0.17 [b]
In the last 2 weeks, I have measured portion sizes	Yes	11 (22.5)	26 (51.0)	0.0005 [a]
In the last 2 weeks, I have counted calories	Yes	10 (20.0)	27 (52.9)	0.0002 [a]
I read nutrition labels for packaged foods	Yes	19 (38.8)	30 (58.8)	0.02 [a]
I read nutrition labels to compare calories	Yes	19 (38.8)	32 (62.8)	0.003 [b]
I read nutrition labels to compare fat	Yes	19 (38.8)	30 (58.8)	0.03 [a]
I read nutrition labels to compare fiber	Yes	14 (28.6)	24 (47.1)	0.01 [b]
I read nutrition labels to compare salt	Yes	12 (24.5)	26 (51.0)	0.001 [b]
I read nutrition labels to compare vitamins and minerals	Yes	16 (32.7)	28 (54.9)	0.005 [a]
I buy whole milk for my family to drink	Yes	9 (19.2)	3 (6.0)	0.03 [b]
I buy reduced-fat milk for my family to drink	Yes	40(85.1)	41 (82.0)	0.41 [a]
I buy low-fat milk for my family to drink	Yes	6 (12.8)	10 (20.0)	0.21 [a]
I buy skim milk for my family to drink	Yes	1 (2.1)	7 (14.0)	0.04 [b]

†glass defined as 8oz. or 1 cup of fluid
‡ Examples of a serving given were: ½ cup of sliced fruit or fruit juice, ¾ cup of frozen vegetables, one small apple, one banana, ten baby carrots, or one ear of corn
1 Not all participants responded to all questions
*Post-tests were given six months after the Pesticide Health Education intervention
a McNemar's Chi Square

There were significant increases in participants reporting that in the last two weeks they increased their number of servings of fruits and vegetables (60% to 80%), measured portion sizes (22% to 51%), and counted calories (20% to 53%) between the pre-test and three month post-test. There were also statistically significant increases between the pre-test and three month post-test in participants reporting reading nutrition labels for packaged foods (39% to 59%), to compare calories (39% to 63%), to compare fat (39% to 59%), to compare fiber (29% to 47%), to compare salt (24% to 51%), and to compare vitamins and minerals (33% to 55%). For the adult behaviors, significantly more adults reported drinking five or more glasses of water per day on the three month post-test (63%) than on the pre-test (42%). However, no significant increase was reported in physical activity or replacing beverages with water. There were significant changes in participants reporting purchasing whole milk (19% to 6%) and skim milk (2% to 14%) for their family to drink between the pre-test and three month post-test, however, there were not statistically significant changes in participants purchasing reduced-fat or low-fat milk for their family to drink.

4.4. Discussion

4.4.1. Knowledge Assessment Responses

When the 38 participants who completed all of the knowledge questions were compared, there were statistically significant differences in the mean scores on the knowledge test between the pre-test and immediate post-test, and between the pre-test and three month post-test. There was an increase of 0.92 (98.33% CI: 0.28, 1.56) points between the pre-test and immediate post-test, an almost 10% increase in the mean participant score following the module. This is a notable degree of change for a preliminary study with a small sample size. For the 41 participants who completed both the pre-test and three month post-test, there was a 0.54 (98.33%CI: -0.21, 1.28) point increase in mean knowledge score on the three month post-test when compared to the pre-test. The difference between the pre-test and three month post-test was not statistically significant; however, there were a relatively small number of knowledge test items and a small sample size.

The healthy behaviors module was long and contained a great deal of information on portions, calories, nutrition labels, nutrients, and physical activity. The knowledge assessment only including ten items researchers thought were emphasized. The scope of this module may have been overly ambitious. *Promotoras* guided the choices in what should be kept in the module based on what they considered important in their community. However, some studies suggest that smaller, more targeted interventions may have a larger impact on knowledge and behaviors (8, 11). It may be

that this module should be broken into a few smaller, more specific modules to have a larger impact on knowledge, attitudes, and behaviors of intervention participants. More emphasis is need on areas of low participant performance such as the benefits of whole grains, a balanced plate, and children's physical activity. Based on these preliminary data, participants were already aware that reading nutrition labels was the best way to determine if a product is healthy. However, following the module, more participants reported reading nutrition labels for packaged foods, calories, salt, fat, fiber, and vitamins and minerals. The module may have improved the ability of the participants to read nutrition labels for such content. The knowledge assessment should be updated to assess participants' abilities to read nutrition labels for content.

4.4.2. Attitudinal Responses

After the module, participants were more likely to report that they were concerned about the growing problem of obesity in the U.S. An interesting juxtaposition was that participants did not report a change in concern over their children's eating habits. There was also no statistically significant increase in concern about children's physical activity. Mexican–American boys and girls have higher rates of obesity at 39.1 % than non-Hispanic whites at 27.9 % (91, 96). Patterns of fat distribution and ethnic differences in BMI may be established at age 5 or six (100). Obese children are more likely to become obese adults. Further, obesity is difficult to treat once it has been established (101, 102). Prevention or treatment of obesity should begin in childhood to prevent obesity-related diseases in adulthood (104). Interventions targeting obesity in

childhood may be more efficacious in the long-term (111). Among Latino youth, parents and other family members have significant influence over nutritional knowledge, behaviors, and physical activity (94, 95). A family-based health intervention, such as the one in this study may have more impact than a study at a school or a study focused on the child as the agent of change. The module should be updated to address the need to fight overweight and obesity in children and adolescents before these patterns become ingrained.

4.4.3. Reported Children's Behavioral Changes

It is interesting to note the participants were more likely to report that they have control over their child's eating habits and amount of physical activity on the three month post-test than on either the pre-test or immediate post-test. Parents may have felt empowered by suggestions for behavior change included in the model, or by making changes at home. While there was not a statistically significant increase in participants reporting changes in their child's physical activity, or changes in servings of fruits and vegetables, there was an increase in participants reporting their children were drinking fewer glasses of soda, and drinking more milk. The percentage of participants who reported their children were drinking one or fewer glasses of soda per day increased from 16% on the pre-test to 65% on the three month post-test. This decrease in soda consumption suggests that the module may have been effective at explaining why children should not drink large amounts of soda. There was not an increase in participant concern over their children's physical activity. This suggests that participants may feel

they have control over their children's habits, but are not exercising this control in areas for which their attitudes are not changing, for example, physical activity. The module may need to be adjusted to focus more on the benefits and reasons for increased physical activity for children and how much physical activity children need.

4.4.4. Participants' Reported Behavior Changes

There was a statistically significant increase in participants reporting drinking five or more glasses of water per day, and an increase, not statistically significant, in participants reporting replacing any beverages with water (Table 4.5). It may be that participants began replacing beverages with water before the two weeks referred to in the question. It is also possible that participants are continuing to drink other beverages, and adding water to their beverage consumption. The time period questions may need to be adapted to better address behavior changes in the three months following the module, however; questions referring to a three month period may make it more difficult for participants to recall changes.

A non-statistically significant change was seen in participants reporting increasing their servings of fruits and vegetables in the past two weeks. This is interesting when there was no change in participants reporting their child ate four or more servings of fruits and vegetables in a typical day. It is possible that participants' children were already eating more servings of fruits and vegetables than their parents. It is also possible that participants are reporting on what they believe their children are

eating at school. Future emphasis may need to be placed on parental role-modeling of healthy eating choices.

While there was no significant change in participants reporting buying reduced-fat or low-fat milk for their families to drink, there was a statistically significant change in in participants reporting buying whole or skim milk for their families to drink. There was a significant decrease in participants reporting purchasing whole milk, and a significant increase in participants reporting purchasing skim milk. Changes in milk purchasing habits suggest that the module may have had an impact on participant concerns over the fat content of milk for drinking.

4.4.5. Limitations

There was no comparison group for this study. Participants were recruited via *promotora* social network, and self-selected into the study. Self-selection may bias results away from the null value, as these participants are likely to be more interested in the module topic and potential changes. As a preliminary study with time and monetary constraints, it was not feasible to implement random participant selection or recruit a comparison group. The results of this module suggest that further work, potentially with comparison groups, should be done in this area.

Behaviors measured in this study were self-reported. Self-reported behaviors may bias the results away from the null, because participants may anticipate responses preferred by researchers. With a three month follow-up visit and questions referring to two week time periods, there may be recall bias, in both specific behaviors and when

behaviors occurred. These limitations may be addressed by more conservative techniques such as providing participants with a logbook to record information, or measurement by the research team of variables such as changes in body weight. Such measurements were beyond the scope of this preliminary study.

This was a preliminary study, and had a limited number of participants. Not all of the participants answered all of the individual assessment items. Because of the small sample size, small differences and changes may not be found to be statistically significant. A small sample size can bias the results towards the null. In spite of the small sample size, a statistically significant change was seen in the mean participant knowledge score between the pre-test and both post-tests. The knowledge assessment was short, and may have had score compression, where a longer assessment may have allowed for greater ability to detect changes in knowledge. Additionally, the significance levels for the various statistical analyses were Bonferroni-adjusted. Even with the more stringent adjustment, there were still statistically significant changes in some assessed knowledge, attitudes, and reported behaviors.

4.4.6. Summary

The healthy behaviors module and assessments should be updated based on the results of this preliminary study to focus on areas of need and low performance. Future studies should include comparison groups and potentially more conservative measures of behavior change. While more work is needed in this area, this study suggests that a

promotoras-delivered health education module may impact some participant knowledge, attitudes, and behaviors relating to healthy eating and a healthy lifestyle.

5. CONCLUSION

5.1. Summary

The purpose of this project was to use environmental health education to increase topic-related health literacy. The topics of the health education interventions were home safety, with a focus on pesticides and nutrition. Both topics were areas of concern in the study communities. By increasing the pesticide- or nutrition-related health literacy of the study participants, an effective health education intervention may empower individuals to avoid exposures, adverse outcomes, and potentially avoid chronic diseases. Our study populations were different geographically, but demographically similar. These communities were primarily comprised of Hispanic families with low SES. The effectiveness of the health education intervention was evaluated using assessments of knowledge, attitudes, and behaviors given to intervention participants prior to, immediately following, and several months after the intervention.

5.1.1. Pesticide Health Education

Webb County participants were largely recruited from incorporated *colonias* located miles from town and most urban conveniences (grocery stores, health services, transportation). At least 80% of the participants were from *El Cenizo* and *Rio Bravo,* the remainder of the participants were from route 359 *colonias* and low income Laredo neighborhoods near route 359. The participants from the Kelly Air Force Base area of San Antonio lived in an urban area. Despite the differences in the locations, participants

in the study communities of Webb County and San Antonio had very similar demographic and pesticide use-related characteristics. In both communities the participants were primarily women, with low income, and preferred Spanish language materials.

Both locations are in South Texas, and thus have similar pests and climate. Fewer participants in Webb County than in San Antonio had air-conditioning. Most participants without air-conditioning also lacked screens on at least some windows. The warm climate requires open windows for multiple months of the year, if air conditioning is not available. The open windows allow pests to enter and may exacerbate pest problems for these participants. This may explain why more participants in Webb County than in San Antonio reported continuing pest problems and planned to use another form of pest control.

Most participants in both communities had used pesticides in the six months prior to the module. Less than 20% of participants used a professional exterminator for pesticide treatment. Professional exterminators are costly, but they decrease the chances of improper use and handling of pesticides. Additionally, about 60% of participants in either community could understand English pesticide labels. Approximately 95% of participants in both communities could understand pesticide labels in Spanish. With the large percentage of participants in each community that reported using pesticides, there is a need for pesticide labels to be available in Spanish. Some brands, including Raid, have Spanish language labels. The popularity of Raid may be, in part, due to the Spanish language labeling.

Approximately 26% of participants in Webb County and 32% in San Antonio reported ever using insecticide chalk, a product that is not legal for use in the U. S.. Insecticide chalk is of a variable pyrethroid composition and is produced in China. Insecticide chalk may be found a various discount stores in the US. Sometimes called miraculous or Chinese chalk, the label of the insecticide reads that it is safe and non-toxic. In addition, the insecticide looks like chalk and may be mistaken by children as a toy. Forrester recently published data from Poison Control Centers, in which almost 200 children in South Texas, over a ten year period, had ingested insecticide chalk (127). Due to language barriers and lack of awareness of the Poison Control Centers, the ingestion cases are likely under-reported (87, 127). In the Forrester paper, it was suggested that health education on insecticide chalk and other illegal pesticides should be done in South Texas (127).

The results from the pesticide-focused home safety education module, suggest that an environmental health education module may be effective in persistently changing the knowledge, attitudes, and behaviors of participants. Participants in Webb County had significant increases in knowledge scores between the pre-test and immediate post-test. Six months following the module, participant scores decreased, but were still significantly higher than before the module. In San Antonio, there were not enough pre-tests to establish a baseline knowledge score; however, both the immediate and the six month post-test knowledge scores were very similar to those of Webb County. The similarities in post-test scores suggest that changes in knowledge were due to the module and not an artifact of exposure to the assessments.

After the module, participants in Webb County were more likely than before the module to think pesticides cause problems and more likely to think about the health effects of pesticides (the same trends were present, but not significant in San Antonio). Also, after the module participants were also more likely than before the module to believe that they had control over their exposures and that they could avoid the negative effects of pesticides. This suggests that the module made participants more aware of the potential health effects of pesticides, while making them feel capable of avoiding pesticide exposures and health effects.

Significantly more participants in Webb County than in San Antonio reported on the pre-test keeping pesticides in unmarked containers. This was one of the concerns that led to the development of the module (53). On the six month post-test there was a significant decrease in the percentage of participants in Webb County who reported using unmarked containers for pesticide storage. Using unmarked containers for pesticide storage increases the likelihood that pesticides may be mistaken for something else and misused, or that the container will be subsequently repurposed. Repurposing of pesticide containers may lead to accidental ingestion or exposure.

In Webb County, almost twice as many participants on the pre-test as on the post-test reported keeping emergency phone numbers near their phones. In San Antonio, there was also an increase in the percentage of participants reporting this behavior, but the increase was neither as large, nor significant. Quick access to emergency phone numbers may be crucial to receive help or information after an accident. The module provided participants with Poison Control Center numbers and explained that there are

different responses needed for different poisonings. It is possible that the San Antonio participants did not report keeping numbers by phones due to cell phone use. That behavior is linked to a time when everyone used a land-line for phone calls. A centrally located list of numbers was more useful with a land-line. The module should be updated to have participants add emergency numbers to their phones. This behavior would also be quantifiable.

5.1.2. Nutrition Education Intervention

The nutrition or healthy behaviors module was only used in San Antonio, as a preliminary study. All of the participants were women and preferred materials in Spanish. Most participants reported that their oldest child, under the age of sixteen, was under the age of twelve, but 23% were 13-16 years of age.

Between the pre-test and the immediate post-test there was a significant increase in mean knowledge score; however, the increase between the pre-test and the three month post-test was not significant. The sample size was small, limiting the power to detect a small effect size. Also, the small maximum score of ten may have compressed the scores leaving low score variability. With a larger sample size or change in knowledge assessment, it may be possible to see a significant increase in the 3-month post-test score over the baseline score. In this study, there was an increase in knowledge that was not persistent.

Three months after the nutrition module, more participants than before the module correctly identified the reasons good nutrition is important and the recommended

servings of fruits and vegetables. On the pre-test, over 90% of participants correctly asserted that reading the nutrition label is the best way to know about a product, that lean meats are healthier, and water should be your primary beverage. The module and assessment need to incorporate prior knowledge to be more effective. In future studies it would be beneficial to pilot-test the module and assessments with a focus group of individuals who are representative of the target population, in order to take into account baselines knowledge, attitudes, and behaviors of the target population. This module and assessments were developed with the input of promotoras and other staff familiar with the target population, but the baseline levels of knowledge, attitudes, and behaviors was still underestimated.

Between the pre-test and the three month post-test, there was a significant increase in the percentage of participants reporting that they have control over both their child's eating habits, and their child's physical activity. Neither attitude was significantly changed between the pre-test and the immediate post-test. This suggests that the participants did not think they had control over their children's habits until attempting to make changes. This change should be emphasized in the future applications of the module.

On the three month post-test, significantly more participants than on the pre-test reported a decrease in their child's soda consumption. The percent having one or fewer servings of soda per day increased from 16% on the pre-test to 65% on the post-test. This suggests that the module was effective in illustrating the amount of sugar and calories in soda. There was also a significant increase in children's water and milk

consumption from the pre-test to the three month post- test. A significant increase in participants' own water consumption was seen between the pre-test and three month post-test. The module emphasized the importance of modeling behaviors for their children.

While the module placed emphasis on the importance of having 5 or 6 serving of fruit and vegetables per day, there was no significant increase in fruit and vegetable consumption among the children or the parents. This may be due to cost, habit, or recipes commonly used. Three months after the module, there was a significant increase in the number of participants reporting that they counted calories or measured portion sizes. Portion sizes were stressed in the module. There were many tips in the module on ways to easily measure portions and what portions were reasonably sized. In order to achieve greater gains in this behavior, portion sizes should be modeled or physically held. In one study, participants were given measuring cups for accurate portion size measurements and the participants had measurable weight loss following the intervention (40).

The module concentrated on how to read nutrition labels and that the label is the best source of information on the food. There were significant increases between the pre-test and three month post-test in the percentage of participants reporting that they read nutrition label on packaged foods and to learn about the content of fat, calories, fiber, salt, vitamins, and minerals. This suggests that the module was effective in teaching participants how to read the nutrition labels and/or communicating the

importance of reading the label for various items. It is hoped that reading the nutrition label will improve food choices and downplay misleading packaging and advertising.

The healthy behaviors nutrition module may not have led to a significant increase in retained knowledge; however, the module may have led to persistent changes in attitudes and behavior.

5.2. Public Health Relevance

Health education interventions, as stand-alone entities, have fallen out of favor in the twenty-first century (18). As a one-part intervention, health education interventions have their primary audience in third world countries(18). The idea behind not using health education in developed countries is that the message is available. This is not true for all messages, and not all communities have equal access to information. The area along the U.S.-Mexico border is a mixture of, but different from, both countries. Underserved populations, particularly immigrant and non-English speaking populations may not be able to receive broadly available messages, because of language, resources, education, and transportation. Additionally, there are concerns that outsiders going into a community may "blame the victim" or deliver the message in a sage-like manner without trying to resolve the problem (128). Use of CHWs or promotoras can mitigate the outsider status. Not only will the promotoras know if the researcher intervention is community-appropriate, they will know if it is relevant. Researchers who are engaged with participants and promotoras and learn about their concerns can work with the community to find services or solutions to these problems.

The new focus is on the broader health promotion interventions that have multiple components, such as organization-building, changes in infrastructure, policy development, and connection to services. Even in health promotion, where health education should play a role, health education is often left out of interventions in the U.S. (18). A full health promotion intervention that includes health education would be an optimal approach to changing behaviors in a community setting, but there are multiple factors that inhibit this approach. Even the cost of CHWs for health education alone is expensive and adding costs for the time and resources required for a broader community intervention only increases this cost.

Promotora-led interventions are also costly; however, these interventions are more effective than print or media alone (16). One way to mitigate costs may be to have *promotora*-led sessions with multiple participants, similar to a focus group. It may be that discussion in a larger group leads to more depth of understanding and retention. Group interventions should have a group size that promotes discussion. A very large, lecture-style intervention may lose the interaction and discussion that allows promotoras to assess their impact. Large group interventions may also pose logistical difficulties for the administration of assessments and consent processes.

The community, the message, and the way the message is delivered all matter. There is not a maximal strategy that will work for all messages, or all communities. Health education is likely to be effective in communities in which the message is new. The San Antonio promotoras were surprised that pesticides are chemicals. Most of the promotoras and participants were unfamiliar with the chemical hazards content of the

home safety module. This module appears to have been effective in changing some attitudes and behaviors regarding pesticides in our study communities. The same type of intervention would be unlikely to work for cessation of cigarette smoking, because more people are familiar with the risks of smoking. Health education is not likely to be effective in communities in which the problem cannot be solved with small accessible changes. For example, health education explaining that there is contamination in the soil that causes health problem in a community would not be enough to help the community. In this case, the community would need help with remediation or the ability to change their location, and education alone would only highlight the problem. The refrain of the promotoras in this study was, "now that we know, what we can do?" This should be kept in mind while planning a health education intervention.

There were persistent changes in pesticide-related knowledge, attitudes, and behaviors following the home safety module. This suggests that a one hour, *promotora*-led education intervention may be able to impact long-term attitudes and behaviors. With changes to the assessments and an expanded sample size an evaluation of the nutrition module may show persistent changes in knowledge. Even without a persistent change in knowledge, there were longer-term changes in attitudes and behaviors following the nutrition module. Knowledge gains (or lack thereof) are not necessarily indicative of the effectiveness of an education intervention. Before delivering an intervention to a community it is important to be aware of the level of knowledge the community brings to the intervention. Planning with CHWs may not give the full picture of the knowledge and awareness of a topic in a community.

The intervention schedule used in this study, with a pre-test, immediate post-test, and a follow-up post-test, may be able to evaluate the persistence of changes following an intervention. Longer-term or multiple follow-up post-tests may be better able to evaluate persistence, but these assessments would be costly in funding and time. Optimally, one should design a randomized controlled trial (RCT) with a control that receives the same schedule and the same assessments, except the module is delayed until after the trial. The RCT would allow the researchers to determine the impact of the assessments on the results.

5.3. Limitations and Future Directions

5.3.1. Limitations

The generalizability of the study may not be representative of all underserved Hispanic communities, or even those in Texas. The recruitment strategy allowed people to self-select. Thus, participants may be those more interested in the topics and may bias results away from the null. In this study it was not feasible to randomly select participants or control participant recruitment. The study recruitment was as broad as possible under the selection and eligibility criteria.

Use of the knowledge test before the module, may have biased the knowledge test results on the post-test. Pre-exposure to the survey instrument could potentially positively bias the results; however, in the home safety module, San Antonio participants did not receive the knowledge pre-tests, and had similar immediate and six-month post-

test scores. This suggests that prior exposure to the instrument did not increase knowledge scores. Attitudes and behaviors were self-reported. Results of the study may be skewed due to recall and self-report. To limit some bias, participants who participated in prior pesticide-related health education were excluded from eligibility. More direct measures of pesticide exposure, dietary changes, and physical activity were beyond the scope of the project.

The numbers of participants involved in the home safety intervention were much higher in Webb County than in San Antonio. The smaller sample size in San Antonio resulted in the inability to detect the same effect sizes as could be detected in the Webb County data. Thus the San Antonio home safety results are biased towards the null. Differences in significance in findings between the two communities may be due to the inability to detect the same effect size. The number of individuals who participated in the nutrition module in San Antonio was also small, limiting the ability to detect small effect sizes and biasing results towards the null.

The baseline knowledge of participants in the San Antonio nutrition intervention was underestimated. The knowledge test developed with input from the San Antonio promotoras assessed information that was too basic for this community. The pre-test scores had little room to improve on the post-tests. In addition, the knowledge for the nutrition module was only ten questions in length. This short survey was designed to lessen the time burden of the participants; however, the short assessment may have had score compression. A longer and less basic survey may have produced more score variability and allowed for detection of changes in knowledge.

There were a large number of tests of significance performed in this analysis; therefore, Bonferroni adjustments were made to the paired t-tests and McNemar's Chi square tests. In the analyses done in this project, the conservative Bonferroni adjustments did not change the significance when compared with the less stringent 95% confidence level.

5.3.2 Future Directions

The modules and assessments need to be updated to incorporate the lessons from this study. The modules should be submitted to the Texas Promotora Training Center and/or the funding agency's websites, to make the information accessible to a wider audience. The modules could be used in a RCT with multiple communities to evaluate the impact of the participant pre-module exposure to the assessments, as well as evaluating the effectiveness of the intervention. To assess the impact of the promotoras, a comparison group using a computer-assisted health education module could be used.

Optimally, this study would be improved by pairing the health education with measurable outcomes, instead of relying on self-reported behaviors. Appropriate measurable outcomes are difficult to find. Biomarkers of pesticide exposure can be found in blood and urine samples. Biomarkers of OP and pyrethroid pesticide exposure are cleared from the blood in a matter of days (56, 129). Venipuncture for blood samples would also cause difficulties in participant recruitment, and added difficulties in consent, particularly for children. For a comparison of pre- and post-intervention levels, blood samples would not cover a reasonable time interval. Diakylphosphate (DAP) urine

concentrations are commonly used as biomarkers of OP pesticide exposure, and can be compared to NHANES data (56, 130). DAPs are not specific to individual OP insecticides. The six possible DAP metabolites are each produced by multiple OPs. Thus, DAPs cannot be used to give information on specific pesticide exposures (129, 131). Zhang et al. reported that plants produce DAPs and that DAPs in urine may not be measuring exposure to just the parent compound, but also the metabolite itself (132). Foods may therefore increase DAPs in urine. The magnitude of the DAPS from plant sources was not addressed in this paper; a duplicate diet study, in which the urine samples and the foods the participants ate were both analyzed for DAPs would be beneficial to resolve the amount of dietary DAPs consumed compared to excreted. Pesticide exposure may be variable, and DAPs may be cleared from urine before an estimate of pesticide exposure can be obtained (129). Long-term exposure estimation would not be possible, because DAPs may be cleared from the urine within 1-2 days of exposure (133). An additional problem with urinary DAP analysis is that it is difficult to conduct, and few labs in the US have the experience and expertise to do this analysis.

Indirect measurements of pesticide exposure are also problematic. OP and pyrethroid pesticides may persist longer indoors where they are protected from degradation by natural means. These pesticides are then able to adhere to dust particles. Household dust may be a good proxy for household pesticide exposure; however, but the research reports are variable (134-137). Detection of pesticide residues in dust samples may depend on the dust particle size (83). It is difficult to get a consistent measure of exposure from household dust collection due to variable cleaning and residue

degradation. For a measure children's pesticide exposure, hand-rinse samples may be used. Hand-rinse samples have the advantage of showing the pesticides actually on the child (134, 137). The disadvantages of hand-rinse samples are variable hand washing prior to collection, variable hand size (though normalizations are attempted with hand tracings for area), and the necessity of rinsing a child's hand with alcohol. More research is needed to find good measures of household pesticide exposures.

There are many possible outcome measures for the nutrition module. To measure weight loss, participants' weight, BMI, and/or adiposity could be measured at different time points in the study. This may limit recruitment. Additionally children's BMI and optimal weight are highly variable with age, gender, and height. Many measures would need to be taken for children. To measure food consumption, an indirect method would be required. Food frequency questionnaires, meal plans, and shopping lists would all be possibilities to measure the types of foods consumed. Detailed diet logs would be necessary for accurate reporting of servings or caloric intake. For physical activity, self-reporting may be necessary, though the assistance of a log or activity book would aid in the reporting.

There are many potential environmental health education topics that could be evaluated with the pre- and post-test method used in this study, including environmental tobacco smoke, sources of carbon monoxide, UV exposure, and arsenic in foods. Some of these topics could be used in the same study populations, but it would also be interesting to develop modules (including the topics of home safety and nutrition) for other underserved populations, for instance Tribal Nations and Vietnamese immigrants.

Finally, funding permitted; these modules should be paired with health promotion in a wider sense. Community organizations should be engaged and built, policy developed at the local or wider level, environmental measures taken, and development of lasting resources for the community developed. This was done wherever possible in the current study, but time and funding were limited.

REFERENCES

1. Sørensen K, Van den Broucke S, Fullam J, Doyle G, Pelikan J, Slonska Z, et al. Health literacy and public health: a systematic review and integration of definitions and models. BMC Public Health 2012;12:80.

2. Catford J, Nutbeam D. Towards a definition of health education and health promotion. Health Education Journal 1984;43:38.

3. US Deparmtent of Health and Human Services. Healthy People 2010: http://www.healthypeople.gov/2010/Document/HTML/Volume1/07Ed.htm US Deparmtent of Health and Human Services.; 2000.

4. Davidhizar R, Brownson K. Literacy, cultural diversity, and client education. The Health Care Manager 1999;18(1):39-47.

5. Speros C. Health literacy: concept analysis. Journal of Advanced Nursing 2005;50(6):633-640.

6. Baker D. The meaning and the measure of health literacy. Journal of General Internal Medicine 2006;21(8):878-883.

7. Quirk P. Screening for literacy and readability: implications for the advanced practice nurse. Clinical Nurse Specialist CNS 2000;14(1):26-32.

8. Brown S, Teufel J, Birch D. Early adolescents perceptions of health and health literacy. The Journal of School Health 2007;77(1):7-15.

9. McCray A. Promoting health literacy. Journal of the American Medical Informatics Association : JAMIA 2005;12(2):152-163.

10. Rothman R, Montori V, Cherrington A, Pignone, M. Perspective: the role of numeracy in health care. Journal of Health Communication 2008;13(6):583-595.

11. Kutner M, Greenberg E, Jin Y, Boyle B, Hsu Y, Dunleavy E. Literacy in everyday life: Results from the 2003 National Assessment of Adult Literacy. In: Statistics NCfE, editor. Washington, DC: U.S. Department of Education; 2007.

12. Bureau USC. Data derived from Population Estimates, American Community Survey, Census of Population and Housing, State and County Housing Unit Estimates, County Business Patterns, Nonemployer Statistics, Economic Census, Survey of Business Owners, Building Permits, Consolidated Federal Funds Report. In: State and County QuickFacts. http://quickfacts.census.gov/qfd/states/48000.html U.S. Census Bureau; 2013.

13. Shin HB, Bruno RR. Language use and English-speaking ability, 2000. US Department of Commerce, Economics and Statistics Administration, http://www.census.gov/prod/2003pubs/c2kbr-29.pdf US Census Bureau 2003.

14. Black K, Shalat S, Freeman N, Jimenez M, Donnelly K, Calvin J. Children's mouthing and food-handling behavior in an agricultural community on the US/Mexico border. Journal of Exposure Analysis and Environmental Epidemiology 2005;15(3):244-251.

15. Elder J, Ayala G, Parra-Medina D, Talavera G. Health communication in the Latino community: issues and approaches. Annual Review of Public Health 2009;30:227-251.

16. Elder J, Ayala G, Campbell N, Slymen D, Lopez-Madurga E, Engelberg M, et al. Interpersonal and print nutrition communication for a Spanish-dominant Latino population: Secretos de la Buena Vida. Health psychology: Official Journal of the Division of Health Psychology, American Psychological Association 2005;24(1):49-57.

17. Cambon L, Minary L, Ridde V, Alla F. Transferability of interventions in health education: a review. BMC public health 2012;12:497.

18. Israel BA, Checkoway B, Schulz A, Zimmerman M. Health Education and Community Empowerment: Conceptualizing and Measuring Perceptions of Individual, Organizational, and Community Control. Health Education & Behavior 1994;21.

19. Elder J, Ayala G, Arredondo, E. Community Health Partnerships for Chronic Disease Prevention Among Latinos: The San Diego Prevention Research Center. Journal of Primary Prevention 2013;34(1-2):17-29.

20. U. S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Community Health Advisors: Models, Research, and Practice: Selected annotations-United States, Volume I. https://archive.org/stream/communityhealtha01usde#page/n1/mode/2up; In: U. S. Department of Health and Human Services, editor; 1994.

21. Pew Hispanic Center. Statistical Portrait of Hipsanics in the United States, 2006. In. 2006 ed. http://pewhispanic.org/files/reports/.pdf: Pew Hispanic Center; 2008.

22. Elder JP, Ayala GX, Arredondo EM, Talavera GA, McKenzie TL, Hoffman L, et al. Community Health Partnerships for Chronic Disease Prevention Among Latinos: The San Diego Prevention Research Center. J Prim Prev 2013; 34(1-2):17-29.

23. Schneider TR. Getting the Biggest Bang for Your Health Education Buck: Message Framing and Reducing Health Disparities. American Behavioral Scientist 2006;49.

24. Krieger N, Smith K, Naishadham D, Hartman C, Barbeau E. Experiences of discrimination: validity and reliability of a self-report measure for population health research on racism and health. Social Science & Medicine (1982) 2005;61(7):1576-1596.

25. Mar´ın G, Triandis H. Allocentrism as an important characteristic of the behavior of L.A. & Latinos. In: Diaz-Guerrero R, editor. Cross-Cultural and National Studies of Social Psychology. Amsterdam, North Holland: North Holl; 1985. p. 85-104.

26. Spector RE. Cultural Diversity in Health and Illness. J Transcult Nurs 2002;13(3):197-9; discussion 200-1.

27. Moore J, Harrison JS, Kay KL, Deren S, Doll LS. Factors associated with Hispanic women's HIV-related communication and condom use with male partners. AIDS Care 1995;7(4):415-27.

28. Litman TJ. The family as a basic unit in health and medical care: a social-behavioral overview. Soc Sci Med 1974;8(9-10):495-519.

29. Ramirez-Valles J. Promoting health, promoting women: the construction of female and professional identities in the discourse of community health workers. Social Science & Medicine 1998;47(11):1749-1762.

30. Kaminer W. Women volunteering: The pleasure, pain, and politics of unpaid work from 1830 to the present. Anchor Press Garden City, NY 1984.

31. Ayala G, Vaz L, Earp J, Elder J, Cherrington A. Outcome effectiveness of the lay health advisor model among Latinos in the United States: an examination by role. Health Education Research 2010;25(5):815-840.

32. Morgan LM. Community participation in health: the politics of primary care in Costa Rica. Cambridge University Press 1993;1.

33. Wilson K, Roe B, Wright L. Telephone or face-to-face interviews?: a decision made on the basis of a pilot study. Int J Nurs Stud 1998;35(6):314-21.

34. Zuvekas A, Nolan L, Tumaylle C, Griffin L. Impact of Community Health Workers on Access, Use of Services, and Patient Knowledge and Behavior. The Journal of Ambulatory Care Management 1999;22(4):33-44.

35. Swider SM. Outcome effectiveness of community health workers: an integrative literature review. Public Health Nurs 2002;19(1):11-20.

36. TX Department of State Health Services and Health and Human Service Commission. Texas Community Health worker Study report to the Texas Legislature: as required by H.B. 2610. http://www.dshs.state.tx.us/mch/pdf/Community_Health_Worker_Study_Report_Final.pdf. In: Commission TX Department of State Health Services and Health and Human Service, editor. 82nd Legislature, regular Session, 2011; 2012.

37. Arcury T, MarÃ-n A, Snively B, HernÃ¡ndez-Pelletier M, Quandt S. Reducing farmworker residential pesticide exposure: evaluation of a lay health advisor intervention. Health Promotion Practice 2009;10(3):447-455.

38. Liebman AK, Juarez PM, Leyva C, Corona A. A pilot program using promotoras de salud to educate farmworker families about the risk from pesticide exposure. J Agromedicine 2007;12(2):33-43.

39. Balcazar H, Byrd T, Ortiz M, Tondapu S, Chavez M. A randomized community intervention to improve hypertension control among Mexican Americans: using the promotoras de salud community outreach model. Journal of Health Care for the Poor and Underserved 2009;20(4):1079-1094.

40. Faucher MA, Mobley J. A community intervention on portion control aimed at weight loss in low-income Mexican American women. J Midwifery Womens Health 2010;55(1):60-4.

41. Texas Border & Mexican Affairs. What is a colnia? In: Texas Border & Mexican Affairs. http://www.sos.state.tx.us/border/colonias/what_colonia.shtml: Texas Secretary of State; 2013.

42. Ghaddar S, Brown C, Pagán J, Díaz V. Acculturation and healthy lifestyle habits among Hispanics in United States-Mexico border communities. Revista panamericana de salud pública = Pan American Journal of Public Health 2010;28(3):190-197.

43. Sharkey JR, Dean WR, Johnson CM. Association of household and community characteristics with adult and child food insecurity among Mexican-origin households in colonias along the Texas-Mexico border. Int J Equity Health 2011;10(1):19.

44. Mier N, Ory MG, Zhan D, Conkling M, Sharkey JR, Burdine JN. Health-related quality of life among Mexican Americans living in colonias at the Texas-Mexico border. Soc Sci Med 2008;66(8):1760-71.

45. Gray VB, Cossman JS, Dodson WL, Byrd SH. Dietary acculturation of Hispanic immigrants in Mississippi. Salud Publica Mex 2005;47(5):351-60.

46. Ward P. Colonias and Public Policy in Texas and Mexico: Urbanization by Stealth. Austin, TX: University of Texas Press; 1999.

47. Ginez A, Tamez H. In: Ross J, Cizmas L, Trueblood A, editors.personal communication (not published); 2013.

48. Johnson NM, Qian G, Xu L, Tietze D, Marroquin-Cardona A, Robinson A, et al. Aflatoxin and PAH exposure biomarkers in a U.S. population with a high incidence of hepatocellular carcinoma. Sci Total Environ 2010;408(23):6027-31.

49. Bradman A, Barr D, Claus-Henn B, Birgit G, Drumheller T, Curry C, Eskenazi B. Measurement of pesticides and other toxicants in amniotic fluid as a potential biomarker of prenatal exposure: a validation study. Environmental Health Perspectives 2003;111(14):1779-1782.

50. Johnston J, Gibson J. Screening houses for vapor intrusion risks: a multiple regression analysis approach. Environmental Science & Technology 2013;47(11):5595-5602.

51. Johnston J, Gibson J. Probabilistic approach to estimating indoor air concentrations of chlorinated volatile organic compounds from contaminated groundwater: a case study in San Antonio, Texas. Environmental Science & Technology 2011;45(3):1007-1013.

52. Muzquiz L, Hernandez C, Espinosa X, Trevino C, Morales R. In: Cizmas L, Ross J, editors. discussion about community concerns and potential educatoin module topics ed, personal communication (not published); 2010.

53. Rincon R, Ginez A, Tamez H. In. discussion on pesticide related issues in Webb County ed, personal communication (not published); 2010.

54. Heudorf U, Butte W, Schulz C, Angerer J. Reference values for metabolites of pyrethroid and organophosphorous insecticides in urine for human biomonitoring in environmental medicine. Int J Hyg Environ Health 2006;209(3):293-9.

55. Office of Prevention Pesticides and Toxic Substances USEPA. Pesticide industry sales and usage – 2000 and 2001 market estimates. In. http://www.epa.gov/oppbead1/pestsales/01pestsales/market_estimates2001.pdf: U.S. Environmental Protection Agency; 2005.

56. Bradman A, Whitaker D, QuirÃ³s L, Castorina R, Claus Henn B, Nishioka M, et al. Pesticides and their metabolites in the homes and urine of farmworker children living in the Salinas Valley, CA. Journal of exposure science & environmental epidemiology 2007;17(4):331-349.

57. Rao P, Quandt SA, Doran AM, Snively BM, Arcury TA. Pesticides in the homes of farmworkers: Latino mothers' perceptions of risk to their children's health. Health Educ Behav 2007;34(2):335-53.

58. Carozza S, Li B, Elgethun K, Whitworth R. Risk of Childhood Cancers Associated with Residence in Agriculturally Intense Areas in the United States. Environmental Health Perspectives 2008;116(2):559-565.

59. Lizardi PS, O'Rourke MK, Morris RJ. The effects of organophosphate pesticide exposure on Hispanic children's cognitive and behavioral functioning. J Pediatr Psychol 2008;33(1):91-101.

60. Ray D, Ray D, Forshaw P. Pyrethroid insecticides: poisoning syndromes, synergies, and therapy. Clinical Toxicology 2000;38(2):95-101.

61. Fengsheng H, Shaoguang W, Lihui L, Shuyang C, Zuowen Z, Jinxiu S. Clinical manifestations and diagnosis of acute pyrethroid poisoning. Archives of Toxicology 1989;63.

62. Slotkin TA, Tate CA, Cousins MM, Seidler FJ. Imbalances emerge in cardiac autonomic cell signaling after neonatal exposure to terbutaline or chlorpyrifos, alone or in combination. Developmental Brain Research 2005;160(2):219-230.

63. Slotkin TA, Seidler FJ. Comparative developmental neurotoxicity of organophosphates in vivo: transcriptional responses of pathways for brain cell development, cell signaling, cytotoxicity and neurotransmitter systems. Brain Research Bulletin 2007;72(4):232-274.

64. Costa L, Cole T, Furlong C. Gene-environment interactions: Paraoxonase (PON1) and Sensitivity to Organophosphate Toxicity. . Laboratory Medicine 2006;37(2):109-114.

65. Furlong CE. Genetic variability in the cytochrome P450-paraoxonase 1 (PON1) pathway for detoxication of organophosphorus compounds. J Biochem Mol Toxicol 2007;21(4):197-205.

66. Fukuyama T, Tajima Y, Ueda H, Hayashi K, Shutoh Y, Harada T, et al. Apoptosis in immunocytes induced by several types of pesticides. J Immunotoxicol 2010;7(1):39-56.

67. Eskenazi B, Bradman A, Castorina R. Exposures of children to organophosphate pesticides and their potential adverse health effects. Environ Health Perspect 1999;107 Suppl 3:409-19.

68. Bouchard M, Chevrier J, Harley K, Kogut K, Vedar M, Calderon N, et al. Prenatal Exposure to Organophosphate Pesticides and IQ in 7-Year Old Children. Environmental Health Perspectives 2011;119(8):1189-95.

69. Tau GZ, Peterson BS. Normal development of brain circuits. Neuropsychopharmacology 2010;35(1):147-68.

70. Rauh VA, Garfinkel R, Perera FP, Andrews HF, Hoepner L, Barr DB, et al. Impact of prenatal chlorpyrifos exposure on neurodevelopment in the first 3 years of life among inner-city children. Pediatrics 2006;118(6):e1845-59.

71. Kao J, Patterson F, Hall J. Skin penetration and metabolism of topically applied chemicals in six mammalian species, including man: An in vitro study with benzo [a] pyrene and testosterone. Toxicology and Applied Pharmacology 1985;81(3 pt 1):502-16.

72. Wohlfahrt-Veje C, Main KM, Schmidt IM, Boas M, Jensen TK, Grandjean P, et al. Lower birth weight and increased body fat at school age in children prenatally exposed to modern pesticides: a prospective study. Environ Health 2011;10:79.

73. Lawrence LJ, Casida JE. Pyrethroid toxicology: mouse intracerebral structure-toxicity relationships. Pesticide Biochemistry and Physiology 1982;18(1):9-14.

74. Olden K, Guthrie J. Children's health: a mixed review. Environ Health Perspect 2000;108(6):A250-1.

75. Faustman EM, Silbernagel SM, Fenske RA, Burbacher TM, Ponce RA. Mechanisms underlying Children's susceptibility to environmental toxicants. Environ Health Perspect 2000;108 Suppl 1:13-21.

76. Reynolds P, Von Behren J, Gunier RB, Goldberg DE, Hertz A, Harnly ME. Childhood cancer and agricultural pesticide use: an ecologic study in California. Environ Health Perspect 2002;110(3):319-24.

77. Shalat SL, Donnelly KC, Freeman NC, Calvin JA, Ramesh S, Jimenez M, et al. Nondietary ingestion of pesticides by children in an agricultural community on the US/Mexico border: preliminary results. J Expo Anal Environ Epidemiol 2003;13(1):42-50.

78. Bearer C. Environmental health hazards: how children are different from adults. The Future of children / Center for the Future of Children, the David and Lucile Packard Foundation 1995;5(2):11-26.

79. Mortensen SR, Chanda SM, Hooper MJ, Padilla S. Maturational differences in chlorpyrifos-oxonase activity may contribute to age-related sensitivity to chlorpyrifos. Journal of Biochemical Toxicology 1996;11(6):279-87.

80. Landrigan P, Claudio L, Markowitz S, Berkowitz G, Brenner B, Romero H, et al. Pesticides and inner-city children: exposures, risks, and prevention. Environmental Health Perspectives 1999;107 Suppl 3:431-437.

81. Holland N, Furlong C, Bastaki M, Richter R, Bradman A, Huen K, et al. Paraoxonase polymorphisms, haplotypes, and enzyme activity in Latino mothers and newborns. Environ Health Perspect 2006;114(7):985-91.

82. Lu C, Barr DB, Pearson M, Bartell S, Bravo R. A longitudinal approach to assessing urban and suburban children's exposure to pyrethroid pesticides. Environmental Health Perspectives 2006;114(9):1419.

83. Lewis R, Fortmann R, Camann D. Evaluation of methods for monitoring the potential exposure of small children to pesticides in the residential environment. Archives of Environmental Contamination and Toxicology 1994;26(1):37-46.

84. Roberts JW, Wallace LA, Camann DE, Dickey P, Gilbert SG, Lewis RG, et al. Monitoring and reducing exposure of infants to pollutants in house dust. Reviews of Environmental Contamination and Toxicology 2009:201:1-39.

85. Egeghy PE, Quackenboss JJ, Catlin S, Ryan PB. Determinants of temporal variability in NHEXAS-Maryland environmental concentrations, exposures, and biomarkers. Journal of Exposure Analysis and Environmental Epidemiology 2004;15:388-97.

86. Mahaffey K. . Environmental lead toxicity: nutrition as a component of intervention. Environ Health Perspect 1999;89:75-78.

87. Belson M, Kieszak S, Watson W, Blindauer K, Phan K, Backer L, et al. Childhood pesticide exposures on the Texas-Mexico border: clinical manifestations and poison center use. American Journal of Public Health 2003;93(8):1310-1315.

88. Julien R, Adamkiewicz G, Levy J, Bennett D, Nishioka M, Spengler J. Pesticide loadings of select organophosphate and pyrethroid pesticides in urban public housing. Journal of Exposure Science & Environmental Epidemiology 2008;18(2):167-174.

89. Carrillo-Zuniga G, Coutinho C, Shalat S, Freeman N, Black K, Jimenez W, et al. Potential Sources of Childhood Exposure to Pesticides in an Agricultural Community. Journal of Children's Health 2004;2(1):29-39.

90. Zuniga Carrillo G, Donnelly K, Cortes D, Olivares E, Gonzalez H, Cizmas L. Border Health 2012: binational collaboration to develop an outreach environmental educational program. Public Health Reports (Washington, D.C. : 1974) 2009;124(3):466-471.

91. Ogden CL, Lamb MM, Carroll MD, Flegal KM. Obesity and socioeconomic status in adults: United States, 2005-2008. NCHS Data Brief 2010(50):1-8.

92. Klohe-Lehman DM, Freeland-Graves J, Anderson ER, McDowell T, Clarke KK, Hanss-Nuss H, et al. Nutrition knowledge is associated with greater weight loss in obese and overweight low-income mothers. J Am Diet Assoc 2006;106(1):65-75; quiz 76-9.

93. Chew LD, Bradley KA, Boyko EJ. Brief questions to identify patients with inadequate health literacy. Fam Med 2004;36(8):588-94.

94. Wojcicki JM, Schwartz N, Jimenez-Cruz A, Bacardi-Gascon M, Heyman MB. Acculturation, dietary practices and risk for childhood obesity in an ethnically heterogeneous population of Latino school children in the San Francisco bay area. J Immigr Minor Health 2012;14(4):533-9.

95. Davison KK, Birch LL. Childhood overweight: a contextual model and recommendations for future research. Obes Rev 2001;2(3):159-71.

96. Flegal KM, Carroll MD, Kit BK, Ogden CL. Prevalence of obesity and trends in the distribution of body mass index among US adults, 1999-2010. JAMA 2012;307(5):491-7.

97. Barlow S, Bobra S, Elliott M, Brownson R, Haire-Joshu D. Recognition of childhood overweight during health supervision visits: Does BMI help pediatricians? Obesity (Silver Spring, Md.) 2007;15(1):225-232.

98. Spear B. Weight Management: Obesity to Eating Disorders. Handbook Of Pediatric Nutrition, Third ed. Samour P and King K editors. Sudbury, MA ; Jones and Barlett Publishers; 2005.

99. Strauss R, Pollack H. Social marginalization of overweight children. Archives of Pediatrics & Adolescent Medicine 2003;157(8):746-752.

100. Park Y, Hartge P, Moore SC, Kitahara CM, Hollenbeck AR, Berrington de Gonzalez A. Body mass index and mortality in non-Hispanic black adults in the NIH-AARP Diet and Health Study. PLoS One 2012;7(11):e50091.

101. Martorell R, Mendoza FS, Castillo RO. Genetic and environmental determinants of growth in Mexican-Americans. Pediatrics 1989;84(5):864-71.

102. Must A, Jacques PF, Dallal GE, Bajema CJ, Dietz WH. Long-term morbidity and mortality of overweight adolescents. A follow-up of the Harvard Growth Study of 1922 to 1935. N Engl J Med 1992;327(19):1350-5.

103. Davis C, Flickinger B, Moore D, Bassali R, Domel Baxter S, Yin Z. Prevalence of cardiovascular risk factors in schoolchildren in a rural Georgia community. The American Journal of The Medical Sciences 2005;330(2):53-59.

104. Berenson GS, Wattigney WA, Bao W, Srinivasan SR, Radhakrishnamurthy B. Rationale to study the early natural history of heart disease: the Bogalusa Heart Study. Am J Med Sci 1995;310 Suppl 1:S22-8.

105. Mazur RE, Marquis GS, Jensen HH. Diet and food insufficiency among Hispanic youths: acculturation and socioeconomic factors in the third National Health and Nutrition Examination Survey. The American Journal of Clinical Nutrition 2003;78(6):1120-1127.

106. Popkin B, Siega-Riz A, Haines P. A comparison of dietary trends among racial and socioeconomic groups in the United States. The New England Journal of Medicine 1996;335(10):716-720.

107. Brewis A. Biocultural aspects of obesity in young Mexican schoolchildren. American journal of human biology : the official journal of the Human Biology Council 2003;15(3):446-460.

108. Harrington S. Overweight in Latino/Hispanic adolescents: scope of the problem and nursing implications. Pediatric Nursing 2008;34(5):389-394.

109. Haas J, Lee L, Kaplan C, Sonneborn D, Phillips K, Liang S-Y. The association of race, socioeconomic status, and health insurance status with the prevalence of overweight among children and adolescents. American Journal of Public Health 2003;93(12):2105-2110.

110. Kumanyika S, Morssink C. Bridging domains in efforts to reduce disparities in health and health care. Health education & behavior : the official publication of the Society for Public Health Education 2006;33(4):440-458.

111. Epstein LH, Valoski A, Wing RR, McCurley J. Ten-year follow-up of behavioral, family-based treatment for obese children. JAMA 1990;264(19):2519-23.

112. Dietz WH. Overweight in childhood and adolescence. N Engl J Med 2004;350(9).

113. Whitaker R, Wright J, Pepe M, Seidel K, Dietz W. Predicting obesity in young adulthood from childhood and parental obesity. The New England Journal of Medicine 1997;337(13):869-873.

114. Nielsen S, Popkin B. Patterns and trends in food portion sizes, 1977-1998. JAMA : the journal of the American Medical Association 2003;289(4):450-453.

115. Byrd-Bredbenner C, Schwartz J. The effect of practical portion size measurement aids on the accuracy of portion size estimates made by young adults. Journal of Human Nutrition and Dietetics : the official journal of the British Dietetic Association 2004;17(4):351-357.

116. Palmeri D, Auld G, Taylor T, Kendall P, Anderson J. Multiple perspectives on nutrition education needs of low-income Hispanics. Journal of Community Health 1998;23(4):301-316.

117. Huerta M, Roemmich J, Kington M, Bovbjerg V, Weltman A, Holmes V, et al. Magnesium deficiency is associated with insulin resistance in obese children. Diabetes Care 2005;28(5):1175-1181.

118. Ray D, Fry J. A reassessment of the neurotoxicity of pyrethroid insecticides. Pharmacology & Therapeutics 2006;111(1):174-193.

119. Perry M, Venners S, Barr D, Xu X. Environmental pyrethroid and organophosphorus insecticide exposures and sperm concentration. Reproductive Toxicology (Elmsford, N.Y.) 2007;23(1):113-118.

120. Kumar S, Gautam A, Agarwal K, Shah B, Saiyad H. Demonstration of sperm head shape abnormality and clastogenic potential of cypermethrin. Journal of Environmental Biology / Academy of Environmental Biology, India 2004;25(2):187-190.

121. Nichols D, Berrios C, Samar H. Texas' community health workforce: from state health promotion policy to community-level practice. Preventing Chronic Disease 2005;2 Spec no.

122. Office of Prevention, Pesticicides, and Toxic Substances., Agency. US Environmental Protection Agency. Pesticide industry sales and usage – 2000 and 2001 market estimates. In. http://www.epa.gov/oppbead1/pestsales/01pestsales/market_estimates2001.pdf: U.S. Environemtnal Protection Agency; 2005.

123. Davidhizar R, Cramer C. "The best thing about the hospitalization was that the nurses kept me well informed" Issues and strategies of client education. Accident and Emergency Nursing 2002;10(3):149-154.

124. Lu C, Barr DB, Pearson M, Bartell S, Bravo R. A longitudinal approach to assessing urban and suburban children's exposure to pyrethroid pesticides. Environmental Health Perspectives 2006;114(9):1419.

125. Social E, and Housing Statistics Division: Poverty . Poverty Thresholds. In: Poverty. February 2012 ed. http://www.census.gov/hhes/www/poverty/data/threshld/: U.S. Census Bureau 2012.

126. Pogoda J, Preston-Martin S. Household pesticides and risk of pediatric brain tumors. Environmental Health Perspectives 1997;105(11):1214-1220.

127. Forrester M. Pediatric insecticide chalk exposures reported to Texas poison centers. Human & Experimental Toxicology 2013;32(5):554-8.

128. Minkler M. Health Education, Health Promotion and the Open Society: An Historical Perspective. Health Education & Behavior 1989;16:17-30.

129. Wessels D, Barr D, Mendola P. Use of biomarkers to indicate exposure of children to organophosphate pesticides: implications for a longitudinal study of children's environmental health. Environmental Health Perspectives 2003;111(16):1939-1946.

130. Adgate J, Barr D, Clayton C, Eberly L, Freeman N, Lioy P, et al. Measurement of children's exposure to pesticides: analysis of urinary metabolite levels in a probability-based sample. Environmental Health Perspectives 2001;109(6):583-590.

131. Barr D, Barr J, Maggio V, Whitehead R, Sadowski M, Whyatt R, et al. A multi-analyte method for the quantification of contemporary pesticides in human serum and

plasma using high-resolution mass spectrometry. Journal of Chromatography. B, Analytical Technologies in the Biomedical and Life Sciences 2002;778(1-2):99-111.

132. Zhang X, Driver J, Li Y, Ross J, Krieger R. Dialkylphosphates (DAPs) in fruits and vegetables may confound biomonitoring in organophosphorus insecticide exposure and risk assessment. Journal of Agricultural and Food Chemistry 2008;56(22):10638-10645.

133. Organization. WH. Biological Monitoring of Chemical Exposure in the Workplace. http://whqlibdoc.who.int/hq/1996/WHO_HPR_OCH_96.1.pdf Geneva: World Health Organization; 1996.

134. Lu C, Fenske R, Simcox N, Kalman D. Pesticide exposure of children in an agricultural community: evidence of household proximity to farmland and take home exposure pathways. Environmental Research 2000;84(3):290-302.

135. Curl C, Fenske R, Kissel J, Shirai J, Moate T, Griffith W, et al. Evaluation of take-home organophosphorus pesticide exposure among agricultural workers and their children. Environmental Health Perspectives 2002;110(12):92.

136. Quandt S, Arcury T, Rao P, Snively B, Camann D, Doran A, et al. Agricultural and residential pesticides in wipe samples from farmworker family residences in North Carolina and Virginia. Environmental Health Perspectives 2004;112(3):382-387.

137. Shalat S, Donnelly K, Freeman N, Calvin J, Ramesh S, Jimenez M, et al. Nondietary ingestion of pesticides by children in an agricultural community on the US/Mexico border: preliminary results. Journal of Exposure Analysis and Environmental Epidemiology 2003;13(1):42-50.

APPENDIX

Questionnaires for the Pesticide (How Safe Is Your Home?) module.

ADDRESS (when consent form was signed):

_____

INTERVIEWER: _____ DATE: _____CDC NUMBER:

_____

DEMOGRAPHIC SURVEY

► FOR EACH QUESTION BELOW, PLEASE SELECT THE ANSWER THAT BEST DESCRIBES YOU.

1. Sex: ☐ Female ☐ Male

2. YOUR DATE OF BIRTH Please write in the month: _____
Please write in the year: _____

CHILD'S DATE OF BIRTH Please write in the month: _____
Please write in the year: _____

3. Your Country of Origin:
   ☐ Mexico
   ☐ U.S.
   ☐ Other, specify: _____

4. What is the highest grade or year of school you completed? (specify) :
   _____

5. What best describes your marital status?

   ☐ Married
   ☐ Widow
   ☐ Divorced/Separated
   ☐ Single/Never Married
   ☐ Other: _____

6. Which language do you prefer to speak the majority of the time? ☐ English ☐ Spanish ☐ Other : _____

7. What was the first language you learned?
☐ English ☐ Spanish ☐ Other: _____

8. If you speak a second language, what was the second language you learned?
☐ English ☐ Spanish ☐ Other: _____
☐ Don't' speak a second language

9. How long have you lived at your current residence?

_____Years
_____ Months
_____ Days
_____ Don't Know

10. What is your household income? Include income from a job and other sources such as rent from rooms or houses, social security, public assistance, or any other income obtained by yourself and others in this household related to you.
Please answer per year or per month.

MONTHLY	YEARLY
☐<$416/month	☐<$5,000/year
☐$416 - $749/month	☐$5,000 - $8,999
☐$750 - $1,082/month	☐$9,000 - $12,999
☐$1,083 - $1,416/month	☐$13,000 - $16,999
☐$1,417 - $1,749/month	☐$17,000 – $20,999
☐$1,750 - $1,999/month	☐$21,000 - $23,999
☐>$2,000/month	☐>$24,000

DIRECCION (cuando se firmó la forma de consentimiento):_____
_____

ENTREVISTADOR(A): _____FECHA: _____
___NUMERO DE CDC: _____

INFORMACIÓN DEMOGRÁFICA

► POR FAVOR CONTESTE TODAS LAS PREGUNTAS LO MEJOR QUE PUEDA.

1. Sexo: ☐ Femenino ☐ Masculino

2. SU FECHA DE NACIMIENTO Por favor escriba el mes: _____ Por favor escriba el año: _____

FECHA DE NACIMIENTO DE SU HIJO(A)
Por favor escriba el mes: _____
Por favor escriba el año: _____

4. ¿En qué país nació usted?
   ☐ México
   ☐ Estados Unidos
   ☐ Otro, especifique: _____

5. ¿Cuál es el año escolar más alto que completó? (especifique) :
   _____

6. ¿Cuál es su estado civil actualmente?

   ☐ Casada/o
   ☐ Separada o Divorciada
   ☐ Viuda
   ☐ Nunca ha estado casada/o
   ☐ Otro, especifique: _____

7. ¿Qué idioma prefiere hablar la mayoría del tiempo?	☐ Inglés	☐Español	☐ Otro : _____
8. ¿Cuál fue su primer idioma?	☐ Inglés	☐Español	☐ Otro: _____
9. Si habla otro idioma, ¿cuál fue su segundo idioma?	☐ Inglés	☐Español	☐ Otro : _____

☐ No hablo otro idioma

10. ¿Cuánto tiempo ha vivido en esta residencia?

_____ Año(s)
_____ Mes(es)
_____ Día(s)
_____ No lo sé

11. ¿Cual es su ingreso combinado de la familia? Esto se refiere a los ingresos de todos los familiares de esta residencia. Incluya ingresos de sueldo de trabajo, renta de un cuarto o casa, beneficios del Seguro de Ingreso Suplementario, pensión de retiro, o dinero en efectivo por parte de un programa de bienestar público.

POR FAVOR MARQUE SU INGRESO MENSUAL O ANNUAL.

MENSUAL	ANNUAL
☐<$416 / mes	☐<$5,000 / anual
☐$416 - $749 / mes	☐$5,000 - $8,999 / anual
☐$750 - $1,082 / mes	☐$9,000 - $12,999 / anual
☐$1,083 - $1,416 / mes	☐$13,000 - $16,999 / anual
☐$1,417 - $1,749 / mes	☐$17,000 – $20,999 / anual
☐$1,750 - $1,999 / mes	☐$21,000 - $23,999 / anual
☐>$2,000 / mes	☐>$24,000 / anual

CDC NUMBER: _____
ADDRESS (when consent form was signed):

_____
INTERVIEWER: _____ DATE:

_____
PRE-TEST: _____ POST-TEST #1: _____ POST-TEST #2: _____ (MARK ONE WITH "X")

PESTICIDE USE BEHAVIORS

1. What kind of structure is your home?

   ☐ Single family home detached or separate from other houses
   ☐ Single family home connected to other houses
   ☐ Multi-family home
   ☐ Trailer/mobile home
   ☐ Other *specify* _____

2. What is the main way you get rid of your trash? *(Check only one)*

   ☐ Local garbage pickup at the house
   ☐ Burn the garbage
   ☐ Take it to a city/county dump
   ☐ Pay private hauler
   ☐ Bury the garbage
   ☐ Other *specify* _____
   ☐ Don't know

3. How long do you normally go before getting rid of your trash?

   ☐ Less than a week
   ☐ Once a week
   ☐ Longer than a week
   ☐ Don't know

4. Do you have running water in this house? ☐ Yes ☐ No

   4b. IF ANSWERED NO ABOVE: Do you share a water faucet with other house(s)? ☐ Yes ☐ No

5. Are there any water leaks or dripping faucets in your kitchen? ☐ Yes ☐ No

6. Does your house have air conditioning? ☐ Yes ☐ No

7. Does your house have screens on the windows?

☐ None of the windows.
☐ Half or fewer of the windows
☐ More than half the windows
☐ All of the windows

8. Do the screens keep out mosquitoes, flies and other bugs? ☐ Yes ☐ No

9. Job of members of this household:

WHO:	JOB: (PLEASE GIVE TITLE)	LENGTH OF TIME
(1) Respondent (You) ☐ Not Employed	Title: (Job) _____ Agriculture ☐ Yes ☐ No Pesticides ☐ Yes ☐ No Other Chemicals ☐ Yes ☐ No	____ Years ____ Months ____ Don't know
(2) Other adult *(specify):* _____ ☐ Not Employed	Title: (Job) _____ Agriculture ☐ Yes ☐ No Pesticides ☐ Yes ☐ No Other Chemicals ☐ Yes ☐ No	____ Years ____ Months ____ Don't know
(3) Other adult *(specify):* _____ ☐ Not Employed	Title: (Job) _____ Agriculture ☐ Yes ☐ No Pesticides ☐ Yes ☐ No Other Chemicals ☐ Yes ☐ No	____ Years ____ Months ____ Don't know
(4) Other adult *(specify):* _____ ☐ Not Employed	Title: (Job)_____ Agriculture ☐ Yes ☐ No Pesticides ☐ Yes ☐ No Other Chemicals ☐ Yes ☐ No	____ Years ____ Months ____ Don't know
(5) Other adult *(specify):* _____ ☐ Not Employed	Title: (Job)_____ Agriculture ☐ Yes ☐ No Pesticides ☐ Yes ☐ No Other Chemicals ☐ Yes ☐ No	____ Years ____ Months ____ Don't know

10. Pesticides are commonly used for cockroaches, insects, termites, rats, and other rodents, fleas and ticks, weeds in the garden or yard, and to keep animals away from your garden or yard. Pesticides are sold in various ways, for example as sprays, liquids, baits, pellets, granules, powders, pet collars, repellants, sticky strips, traps, bombs, collars for pet animals, and others.

Have you had any pest or weed problems in the last six months? ☐ Yes ☐ No

11. What problems have you had?

Ants	☐ Yes	☐ No
Cockroaches	☐ Yes	☐ No
Termites	☐ Yes	☐ No
Fleas or ticks	☐ Yes	☐ No
Wasps	☐ Yes	☐ No
Other Insects	☐ Yes	☐ No
Rats or other rodents	☐ Yes	☐ No
Weeds	☐ Yes	☐ No
Others specify:		

12. Have you or anyone else used pesticides in your home in the last six months? ☐ Yes ☐ No

13. IF YOU ANSWERED YES ABOVE: Has a professional exterminator used pesticides in your home in the last six months? ☐ Yes ☐ No

14. Do you continue to have problems with any of the pests you are trying to control? ☐ Yes ☐ No

15. Are you going to try something else to control the pests?

☐ Yes (*specify what in respondent's own words)*

_____

_____

☐ No

☐ Don't know

16. Do you have any pets that enter or live inside your house such as dogs, cats, rabbits, birds, etc?

☐ Yes

☐ No

17. IF YOU ANSWERED YES ABOVE: Have you used any chemicals or collars on any animal pets (dogs, cats, birds, etc.) to control fleas, ticks, flies or other insect pests?

☐ Yes

☐ No

☐ Don't know

☐ Don't own an animal

18. Are you able to understand pesticide labels that are written in English? ☐ Yes ☐ No

18b. Are you able to understand pesticide labels that are written in Spanish? ☐ Yes ☐ No

19. Head lice are a common problem for children. Have you treated anyone in your family for head lice?

☐ Yes
☐ No

20. If you have treated someone in your family for lice, what treatment did you use?

(*Please give the name of the product*
_____)

☐ Never had a problem with lice

21. Have you ever used a pesticide called "airplane powder"? ☐ Yes ☐ No

22. Have you ever used a pesticide called "DDT"? ☐ Yes ☐ No

23. Have you ever used a product called "Chinese chalk" or "miraculous chalk"? ☐ Yes ☐ No

NÚMERO DE CDC: _____
DIRECCION (cuando se firmó la forma de consentimiento):_____

ENTREVISTADOR(A): _____FECHA: _____

PRE-EXAMEN ___ POST-EXAMEN #1 ___ POST-EXAMEN #2____ (escoger uno y poner un "X")

USO DE PESTICIDAS

1. ¿Qué clase de estructura tiene su casa?
   - ☐ Casa para una familia separada de otras casas
   - ☐ Casa para una familia pegada a otras casas
   - ☐ Casa multifamiliar (en donde viven mas de una familia)
   - ☐ Casa remolque/trailer
   - ☐ Otro, *especifique* _____

2. ¿Cual es la manera principal que usted usa para tirar la basura? (Escoja sólo una)
   - ☐ El camión recolector recoge la basura
   - ☐ Quema la basura
   - ☐ Lleva la basura al basurero de la ciudad o del condado
   - ☐ Paga a una transportista privado
   - ☐ Entierra la basura
   - ☐ Otro, *especifique* _____
   - ☐ No sé

3. Por lo general, ¿cuánto tiempo pasa antes de que usted tire la basura?
   - ☐ Menos de una semana
   - ☐ Una vez a la semana
   - ☐ Más de una semana
   - ☐ No sé

4.	¿Tiene usted agua corriente en su casa?	☐ Sí	☐ No
	4b. SI CONTESTÓ QUE NO: ¿Comparte una llave de agua con otra casa(s)?	☐ Sí	☐ No
5.	¿Tiene fugas de agua o gotea la llave del agua en su cocina?	☐ Sí	☐ No
6.	¿Tiene aire acondicionado en su casa?	☐ Sí	☐ No

¿Tiene telas mosquiteras en las ventanas de su casa?

☐ Ninguna de las ventanas
☐ La mitad o menos de las ventanas
☐ Más de la mitad de las ventanas
☐ Todas las ventanas

8. ¿Sus telas mosquiteras previenen la entrada a la casa de los mosquitos, las moscas y otros insectos?

☐ Sí
☐ No

9. Trabajo de miembros de su casa:

QUIÉN:	**TRABAJO:**	**TIEMPO QUE DURO EN ESTE TRABAJO:**
(1) Usted ☐ No trabaja	Título: (¿Qué hace?) _____ Agricultura ☐ Sí ☐ No Pesticidas ☐ Sí ☐ No Otras sustancias químicas ☐ Sí ☐ No	____ Año(s) ____ Mes(es) ____ No sé
(2) Otro adulto *(especifique):* _____ ☐ No trabaja	Título: (¿Qué hace?) _____ Agricultura ☐ Sí ☐ No Pesticidas ☐ Sí ☐ No Otras sustancias químicas ☐ Sí ☐ No	____ Año(s) ____ Mes(es) ____ No sé
(3) Otro adulto *(especifique):* _____ ☐ No trabaja	Título: (¿Qué hace?) _____ Agricultura ☐ Sí ☐ No Pesticidas ☐ Sí ☐ No Otras sustancias químicas ☐ Sí ☐ No	____ Año(s) ____ Mes(es) ____ No sé
(4) Otro adulto *(especifique):* _____	Título: (¿Qué hace?) _____ Agricultura ☐ Sí ☐ No	____ Año(s) ____ Mes(es) ____ No sé

☐ No trabaja	Pesticidas ☐ Sí ☐ No Otras sustancias químicas ☐ Sí ☐ No	
(5) Otro adulto *(especifique):* _____ _ ☐ No trabaja	Título: (¿Qué hace?) _____ Agricultura ☐ Sí ☐ No Pesticidas ☐ Sí ☐ No Otras sustancias químicas ☐ Sí ☐ No	____ Año(s) ____ Mes(es) ____ No sé

10. Los pesticidas se usan comúnmente para cucarachas, insectos, termitas, ratas, otros roedores, pulgas, garrapatas, hierbas malas en el jardín o la yarda, y para mantener animales lejos de su jardín o yarda. Se venden pesticidas de varios tipos como por ejemplo rociadores, líquidos, cebos, pastillas, gránulos, polvos, repelentes, tiras adhesivas, trampas, bombas, collares para animales, y otros.

    ¿Usted ha tenido algún problema con insectos, otras plagas, o hierbas malas en los últimos seis meses?

    ☐ Sí
    ☐ No

11. ¿Qué problemas ha tenido usted?

Hormigas	☐ Sí	☐ No
Cucarachas	☐ Sí	☐ No
Termitas	☐ Sí	☐ No
Pulgas o garrapatas	☐ Sí	☐ No
Avispas	☐ Sí	☐ No
Otros insectos	☐ Sí	☐ No
Ratas u otros roedores	☐ Sí	☐ No
Hierbas malas	☐ Sí	☐ No
Otro (*especifique*):		

12. ¿Ha usted o cualquier otra persona usado pesticidas en su casa en los últimos 6 meses? ☐ Sí ☐ No
13. ¿Un exterminador profesional ha utilizado pesticidas en su casa en los últimos 6 meses? ☐ Sí ☐ No

14. ¿Usted sigue teniendo problemas con alguna peste que usted esta tratando de controlar? ☐ Sí ☐ No

15. ¿Usará usted algo más para controlar las plagas?
☐ Sí (*especifique en las palabras de la persona entrevistada*):
_____
_____
☐ No
☐ No sé

16. ¿Tiene usted animales que viven dentro de su casa, como perros, gatos, pájaros, conejos, etc.?
☐ Sí
☐ No

17. SI CONTESTÓ "SI" A LA PREGUNTA ANTERIOR: Para sus animales de la casa (perros, gatos, pájaros, caballos, etc.), ¿ha utilizado usted alguna sustancia química o collar para controlar a las pulgas, las garrapatas, las moscas u otras plagas?
☐ Sí
☐ No
☐ No sé
☐ No posee ningún animal

18. ¿Usted puede entender etiquetas de pesticidas que están escritas en Inglés? ☐ Sí ☐ No

18b. ¿Usted puede entender etiquetas de pesticidas que están escritas en Español? ☐ Sí ☐ No

19. Los piojos son un problema común para niños. ¿Ha tratado usted a alguien en su familia para los piojos?
☐ Sí
☐ No

20. Si usted ha tratado a alguien en su familia para piojos, ¿qué tratamiento usó?
(*Por favor, dé el nombre del producto*
_____)

☐ Nunca ha tenido un problema con piojos

21. ¿Alguna vez, ha utilizado usted un pesticida que se llama “polvo de avión”? ☐ Sí ☐ No

22. ¿Alguna vez, ha utilizado usted un pesticida que se llama “DDT”? ☐ Sí ☐ No

23. ¿Alguna vez, ha utilizado usted un producto que se llama “tiza o gis chino” o “tiza o gis milagroso”? ☐ Sí ☐ No

CDC NUMBER: _____

ADDRESS (when consent form was signed):

_____

INTERVIEWER: _____DATE:_____

PRE-TEST _____ POST-TEST #1 _____ POST-TEST #2_____ (choose one & mark with an "X")

How Safe is Your Home?

For each question below, circle the most correct answer. Please choose only one answer for each question.

1. Children are more vulnerable to dangers at home because:
   a. They play on the floor and pick up contaminants off the floor
   b. Their bodies are still developing
   c. Children have a natural reaction to put things in their mouth
   d. For their size, children eat, drink, and breathe more compared to adults, exposing them to more contamination
   e. All of the above (a, b, c and d) are correct.

2. Which of the following is **NOT** a hazardous household product?
   a. Bleach (Clorox)
   b. Baking soda
   c. Weed killer
   d. Insect repellant

3. When using pesticides, you should:
   a. Mix the pesticides all at once
   b. Mix them in a large container
   c. Always follow the directions printed on the label
   d. Allow your children to play in the sprayed areas immediately after spraying
   e. Dump the leftover pesticide down the drain or in your backyard

4. Which of the following is OK to do?
   a. Using appliances away from sink or bathtubs
   b. Using electrical appliances when cords are frayed
   c. Unplugging appliances by pulling the cord

5. How long should you stay out of areas after it has been treated with pesticides?
   a. 2-3 hours
   b. 6-8 hours
   c. 12-16 hours
   d. 24-48 hours
   e. 1 week

Read each question carefully and then circle **Yes** if the statement is correct, and **No** if the statement is wrong.

6. Some people can get sick from pesticides faster than others even though they live in the same place.	Yes	No
7. It is OK to store water in containers that have been used for storing pesticides.	Yes	No
8. Pesticide poisonings may have immediate but not effects weeks, months or years after it occurs.	Yes	No
9. It is safe to allow children to play in an area that has been recently treated with pesticides soon after it has been treated.	Yes	No
10. Pesticides can enter the body through the skin.	Yes	No
11. It is a good idea to store pesticides for roaches and ants where small children can reach them so that they can use the pesticides if they need to.	Yes	No
12. Washing hands with soap and cold water removes pesticides from hands.	Yes	No
13. Allergies or asthma may be affected by the use of pesticides.	Yes	No
14. Pesticides may cause birth defects and nerve damage.	Yes	No
15. After having used pesticides, you should wash your clothes alone (separate from other laundry) in the next load of clothes you wash.	Yes	No

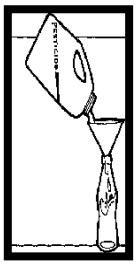
Read each of the following questions and choose the most correct answer.

16. Yes or No: This is a hazardous product.

Yes
No

17. Which one of the following is a safe way to store pesticides?

A	B	C	D
In a cabinet with food	In a top cabinet	In a Ziploc bag	In an empty plastic Soda or water bottle



18. Yes or No: These containers can be used to store pesticides.

Yes

No

19. Which of the following pesticides is illegal in the United States?

A	B	C	D
Weed-B-Gone	Flea Collar	Chinese Miraculous Chalk	Sevin Pesticide


ORTHO
WEED B GON
KILLS WEEDS, NOT LAWNS


MIRACULOUS
INSECTICIDE
CHALK
MADE IN CHINA

Sevin

NÚMERO DE CDC:_____
DIRECCION (cuando se firmó la forma de consentimiento):_____

ENTREVISTADOR(A): _____ FECHA: _____

PRE-EXAMEN ____ POST-EXAMEN #1 ___ POST-EXAMEN #2___ (escoger uno y poner un "X")

¿Qué tan Seguro es Su Hogar?

Circule la respuesta correcta para cada pregunta. Por favor escoja solo una respuesta por pregunta.

1. Los niños son más propensos a los peligros en el hogar porque:
   a. Juegan en el piso en el cual recogen contaminantes
   b. Sus cuerpos todavía se están desarrollando
   c. Los niños tienen la reacción natural de poner las cosas en su boca
   d. Los niños están mas expuestos a los contaminantes porque debido a su tamaño, comen, toman y respiran más que un adulto
   e. Todas las razones de arriba (a, b, c y d) son correctas.

2. ¿Cuál de los siguientes productos NO es peligroso para usarse en el hogar?
   a. Blanqueador (clorox)
   b. Bicarbonato (baking soda)
   c. Herbicida
   d. Repelente de insectos

3. Cuando use pesticidas, usted deberá:
   a. Mezclar todos los pesticidas de una vez
   b. Mezclarlos en un recipiente grande
   c. Seguir siempre las instrucciones de la etiqueta
   d. Permitir que los niños jueguen en áreas en donde acaba de rociar pesticidas
   e. Tirar lo que quede de pesticida en el drenaje o en el patio de su casa

4. ¿ Cuál de estas cosas se puede hacer para evitar riesgos?
   a. Usar aparatos eléctricos lejos de los lavabos y las tinas de baño
   b. Usar los aparatos eléctricos cuando el cordón esta dañado
   c. Desconectar los aparatos eléctricos jalando el cordón

6. ¿Cuanto tiempo debe esperar antes de entrar a áreas que han sido tratadas con pesticidas?

a. 2-3 horas
b. 6-8 horas
c. 12-16 horas
d. 24-48 horas
e. 1 semana

Lea las siguientes preguntas y circule la respuesta adecuada. Circule la palabra "Sí" si cree que la frase es cierta y circule "No" si cree que la respuesta no es cierta.

6. Algunas personas se enferman por exponerse a pesticidas más rápido que otras, aunque vivan en el mismo lugar.	Sí	No
7. Es seguro guardar agua en recipientes que se han usado para guardar pesticidas.	Sí	No
8. El envenenamiento por pesticidas puede tener efectos inmediatos pero no a largo plazo (días, semanas, meses o años despues).	Sí	No
9. Esta bien dejar que los niños jueguen en áreas inmediatamente después de haberlas tratado con pesticidas.	Sí	No
10. La piel es una de las rutas por la cual los pesticidas entran en el cuerpo.	Sí	No
11. Es una buena idea guardar pesticidas para cucarachas y hormigas en un lugar donde los niños pequeños puedan alcanzarlos y puedan usarlos si los necesitan.	Sí	No
12. Al lavarnos las manos con agua fría y jabón eliminamos los pesticidas de las manos.	Sí	No
13. Los pesticidas pueden afectar las alergias y el asma.	Sí	No
14. Los pesticidas pueden ocasionar defectos de nacimiento o daño al sistema nervioso.	Sí	No
15. Después de haber usado pesticidas, debe asegurarse de lavar su ropa sola o separada de otra ropa sucia en la siguiente carga de ropa que lave.	Sí	No

Lea cada una de las siguientes preguntas y elija la respuesta correcta

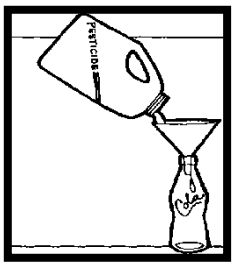
18. Sí o No: Este es un producto peligroso.

Sí

No

19. ¿Cuál de las siguientes formas es la más segura para guardar pesticidas?

A	B	C	D
En un gabinete Con comida	En un gabinete Alto	En una bolsa "ziploc"	En una botella de agua o soda



18. Los siguientes recipientes se pueden usar para guardar pesticidas.

Si

No

19. ¿Cuál de los siguientes pesticidas es ilegal en los Estados Unidos?

A. Weed-B-Gon B. Collar para pulgas C. Tiza o Gis chino D. Pesticida "Sevin"


ORTHO
WEED B GON
KILLS WEEDS, NOT LAWNS


MIRACULOUS
INSECTICIDE
CHALK
MADE IN CHINA

Sevin

CDC NUMBER: _____
ADDRESS (when consent form was signed):
_____

INTERVIEWER: _____DATE: __
_____

PRE-TEST _____ POST-TEST #1 _____ POST-TEST #2_____ (choose one & mark with an "X")

HOW SAFE IS YOUR HOME TECHNICAL ASSESSMENT

- Please circle how often you do the following activities. .

	Never	Rarely	Some-times	Usually	Always
1. I wash my hands with cold water after using pesticides.	1	2	3	4	5
2. It is necessary to wash my hands after applying pesticides.	1	2	3	4	5
3. I keep pesticides out of the reach of my children.	1	2	3	4	5
4. I use electrical cords that are damaged.	1	2	3	4	5
5. I read the instructions on the label before applying pesticides.	1	2	3	4	5
6. I use gloves when using pesticides.	1	2	3	4	5
7. I have emergency phone numbers next to the phone in case of a poisoning.	1	2	3	4	5

8. I keep pesticides in unmarked containers.	1	2	3	4	5
9. I have areas of standing water or moisture around my home.	1	2	3	4	5

FOR EACH QUESTION PLEASE CHOOSE ONLY ONE RESPONSE.

1. Do you think pesticides can cause health problems?
   - ☐ Yes
   - ☐ No
   - ☐ I'm Not Sure

2. How often in the past month have you thought about health effects of pesticides?
   - ☐ Never
   - ☐ Daily
   - ☐ Once a Week
   - ☐ Once a Month

3. Have you ever become sick from being around pesticides?
   - ☐ No
   - ☐ Yes, but not enough to cause a concern
   - ☐ Yes, enough to cause some concern
   - ☐ Yes, enough to worry a great deal

4. Do you believe your past or current use of pesticides will affect your health in the future?
   - ☐ No
   - ☐ Yes, but not enough to cause a concern
   - ☐ Yes, enough to cause some concern
   - ☐ Yes, enough to worry a great deal

5. Do you believe that pesticides can affect the health of children?
   - ☐ No
   - ☐ Yes, but not enough to cause a concern
   - ☐ Yes, enough to cause some concern
   - ☐ Yes, enough to worry a great deal

6. How much control do you feel you have over avoiding any negative health effects of pesticides?
   - ☐ No control
   - ☐ Very little control
   - ☐ Some control
   - ☐ Great deal of control

7. How much control do you feel you have over the amount of pesticides you are exposed to?
   - ☐ No control
   - ☐ Very little control
   - ☐ Some control
   - ☐ Great deal of control

NÚMERO DE CDC:_____
DIRECCION (cuando se firmó la forma de consentimiento):_____
_____

ENTREVISTADOR(A): _____FECHA: _____
_____

PRE-EXAMEN ___ POST-EXAMEN #1 ___ POST-EXAMEN #2___ (escoger uno y poner un "X")

¿QUE TAN SEGURO ES SU HOGAR? EVALUACION TECNICA

- Por favor marque que tan seguido hace cada cosa.

	Nunca	Raramente	Algunas Veces	Comúnmente	Siempre
1. Me lavo las manos con agua fría después de usar pesticidas.	1	2	3	4	5
2. Es necesario lavarme las manos después de usar pesticidas.	1	2	3	4	5
3. Yo guardo los pesticidas fuera del alcance de los niños.	1	2	3	4	5
4. Yo uso cordones eléctricos que están dañados.	1	2	3	4	5
5. Yo leo las instrucciones en la etiqueta antes de aplicar pesticidas.	1	2	3	4	5
6. Yo uso guantes cuando uso pesticidas.	1	2	3	4	5
7. Yo tengo los números de teléfono de emergencia cerca en caso de envenenamiento.	1	2	3	4	5

8. Yo guardo los pesticidas en recipientes que no están señalados o marcados.	1	2	3	4	5
9. Yo tengo áreas de agua estancada o humedad alrededor de la casa.	1	2	3	4	5

- **POR CADA RESPUESTA, POR FAVOR ESCOGA SOLO UNA RESPUESTA.**

1. ¿Usted creé que los pesticidas pueden causar problemas de salud?
   - ☐ Sí
   - ☐ No
   - ☐ No estoy seguro

3. En el mes pasado, ¿Que tan seguido ha pensado sobre los efectos de pesticidas en la salud?
   - ☐ Nunca
   - ☐ Diario
   - ☐ Una vez a la semana
   - ☐ Una vez al mes

3. ¿Se ha enfermado usted a causa de los pesticidas alguna vez?
   - ☐ Nunca
   - ☐ Sí, pero no me preocupa
   - ☐ Sí, y me preocupa un poco
   - ☐ Sí, y me preocupa bastante

4. ¿Creé usted que su uso de pesticidas, ya sea en el pasado o en el presente, lo enfermará en el futuro?
   - ☐ No
   - ☐ Sí, pero no me preocupa
   - ☐ Sí, y me preocupa un poco
   - ☐ Sí, y me preocupa bastante

5. ¿Creé usted que los pesticidas pueden afectar la salud de los niños?
   - ☐ No
   - ☐ Sí, pero no me preocupa
   - ☐ Sí, y me preocupa un poco
   - ☐ Sí, y me preocupa bastante

6. ¿Creé usted que tiene control para evitar efectos dañinos de los pesticidas?
   - ☐ No tengo control
   - ☐ Tengo muy poco control
   - ☐ Tengo algo de control
   - ☐ Tengo muchísimo control

7. ¿Qué tanto control cree tener sobre la cantidad de pesticidas a que está usted expuesto?

   - ☐ No tengo control
   - ☐ Tengo muy poco control
   - ☐ Tengo algo de control
   - ☐ Tengo muchísimo control

Questionnaires for the Nutrition (Healthy Food, Healthy Families) module.

CDC NUMBER: _____

ADDRESS (when consent form was signed):

_____

INTERVIEWER: _____DATE:_

_____

DEMOGRAPHIC SURVEY (NUTRITION MODULE)

► FOR EACH QUESTION, PLEASE SELECT THE ANSWER THAT BEST DESCRIBES YOU.

1. Sex: ☐ Female ☐ Male

2. Your Country of Origin:
   - ☐ Mexico
   - ☐ U.S.
   - ☐ Other, specify: _____

3. What is the highest grade or year of school you completed? (specify):

_____

4. What best describes your marital status?
   - ☐ Married
   - ☐ Widow
   - ☐ Divorced/Separated
   - ☐ Single/Never Married
   - ☐ Other: _____

12. Which language do you prefer to speak the majority of the time? ☐ English ☐ Spanish ☐ Other : _____

13. What was the first language you learned? ☐ English ☐ Spanish ☐ Other: _____

14. If you speak a second language, what was the second language you learned? ☐ English ☐ Spanish ☐ Other: _____

☐ Don't' speak a second language

15. How long have you lived at your current residence?

_____Years
_____ Months
_____ Days
_____ Don't Know

NUMERO DE CDC: _____

DIRECCION (cuando se firmó la forma de consentimiento):_____

ENTREVISTADOR(A): _____FECHA: _____

CUESTIONARIO DEMOGRAFICO (MODULO DE NUTRICION)

►PARA CADA PREGUNTA, POR FAVOR SELECCIONE LA RESPUESTA QUE LE DESCRIBE MEJOR A USTED.

1. Sexo: ☐ Femenino ☐ Masculino

2. País de origen:
   - ☐ México
   - ☐ Estados Unidos
   - ☐ Otro, especifique: _____

3. ¿Cuál es el grado de escolaridad más alto que Ud. terminó? (especifique):

_____

4. ¿Cuál es su estado marital?
   - ☐ Casado(a)
   - ☐ Vuido(a)
   - ☐ Divorciado(a)/Separado(a)
   - ☐ Soltero(a)/Nunca casado(a)
   - ☐ Otro: _____

5.	¿Cuál idioma prefiere Ud. hablar la mayoría del tiempo?	☐ Inglés	☐ Español	☐ Otro: _____
6.	¿Cuál fue el primer idioma que Ud. aprendió?	☐ Inglés	☐ Español	☐ Otro: _____
7.	Si Ud. habla un segundo idioma.¿Cuál fue el segundo idioma que Ud. aprendió?	☐ Inglés	☐ Español	☐ Otro: _____

☐ No hablo un segundo idioma

8. ¿Cuánto tiempo ha vivido en su residencia actual?
   _____Años
   _____ Meses
   _____Días
   _____No sé

CDC NUMBER: _____

ADDRESS (when consent form was signed):

_____

INTERVIEWER: _____DATE:_

_____

PRE-TEST _____ POST-TEST #1_____ POST-TEST #2_____ (choose one & mark with an "X")

NUTRITION KNOWLEDGE SURVEY

Please choose only one answer per question.

1. Good nutrition is important because:
    a. Vitamins and minerals prevent diseases
    b. It may prevent heart disease
    c. It may prevent type 2 diabetes
    d. It may prevent obesity
    e. All of the above (a, b, c, and d) are correct

2. How many servings of fruits and vegetables should you eat per day?
    a. 2 or fewer
    b. 3
    c. 4
    d. 5 or more

3. At least how much of the grains you eat should be whole grains?
    a. None
    b. ¼
    c. ½
    d. All

4. What is the best way to know if a product is healthy?
    a. Brand of the product
    b. Read the nutrition label
    c. The advertisements
    d. The packaging

5. A balanced plate should be:
    a. ½ fruits and vegetables, ¼ grains and potatoes, ¼ meats and proteins
    b. ¼ fruits and vegetables, ½ grains and potatoes, ¼ meats and proteins
    c. ¼ fruits and vegetables, ¼ grains and potatoes, ½ meats and proteins

6. When reading a nutrition label, what items should you limit?
    a. fats
    b. sugars
    c. salt
    d. All of the above (a, b, and c) are correct

7. What type of meats are the most healthy to eat?
    a. Packaged (bologna, deli meats)
    b. Cured (bacon, pepperoni)
    c. Lean (turkey, chicken, fish)
    d. Red (ground beef, steaks)

8. Which beverage should make up most of what you drink?
    a. soda
    b. kool-aid
    c. fruit juice
    d. water

9. Fruits and vegetables should be washed:
    a. By soaking
    b. In cold running water
    c. With soap
    d. Only when not peeled

10. How much physical activity do children need per day?
    a. 30 minutes
    b. 45 minutes
    c. 60 minutes
    d. 90 minutes

NUMERO DE CDC: _____

DIRECCION (cuando se firmó la forma de consentimiento):

_____

ENTREVISTADOR(A): _____FECHA: _____

PRE-EXAMEN_____POST-EXAMEN #1____ POST-EXAMEN #2___(escoja uno y marque con una "X")

CUESTIONARIO DE CONOCIMIENTO SOBRE NUTRICION

Por favor escoja solo una respuesta para cada pregunta.

1. Una buena nutrición es importante porque:
    a. Las vitaminas y minerales previenen las enfermedades
    b. Puede prevenir enfermedades del corazón
    c. Puede prevenir la diabetes tipo 2
    d. Puede prevenir la obesidad
    e. Todas las mencionadas (a,b,c y d) están correctas

2. ¿Cuántas porciones de frutas y vegetales Ud. debe comer al día?
    a. 2 ó menos
    b. 3
    c. 4
    d. 5 ó más

3. Por lo menos ¿Cuántos de los granos que Ud. come deben ser granos enteros?
    a. Ninguno
    b. ¼
    c. ½
    d. Todos

4. ¿Cuál es la mejor manera de saber si un producto es saludable?
    a. Marca del producto
    b. Leer la etiqueta de nutrición
    c. Los anuncios
    d. El empaque

5. Un plato balanceado deber ser:
    a. ½ de frutas y vegetales, ¼ de granos y papas, ¼ de carnes y proteínas
    b. ¼ de frutas y vegetales, ½ de granos y papas, ¼ de carnes y proteínas
    c. ¼ de frutas y vegetales, ¼ de granos y papas, ½ de carnes y proteínas

6. Cuando lee Ud. una etiqueta de nutrición.¿Qué artículos debe limitar?
    a. Grasas
    b. Azúcares
    c. Sal
    d. Todas las mencionadas (a, b y c) están correctas

7. ¿Qué clase de carnes son las más saludables para comer?
    a. Empaquetadas (bologna, carnes del deli)
    b. Curadas (tocino, peperoni)
    c. Sin grasa (pavo, pollo, pescado)
    d. Carnes rojas (carne molida de res, filete)

8. ¿Cuál bebida debe ser la que más debe Ud. beber?
    a. Soda
    b. Kool-aid
    c. Jugo de fruta
    d. Agua

9. Las frutas y vegetales deben lavarse:
    a. Remojandolas
    b. En agua fria corriente
    c. Con jabón
    d. Solamente cuando no se pelan

10. ¿Cuánta actividad física necesitan sus niños al día?
    a. 30 minutos
    b. 45 minutos
    c. 60 minutos
    d. 90 minutos

CDC NUMBER: _____

ADDRESS (when consent form was signed):

_____

INTERVIEWER: _____DATE:_____

PRE-TEST ___ POST-TEST #1____ POST-TEST #2_____ (choose one & mark with an "X")

NUTRITION ATTITUDES SURVEY

- Please circle how strongly you agree with the following statement.

	Strongly Disagree	Tend to disagree	Neither agree nor disagree	Tend to agree	Strongly Agree
1. Eating habits affect my health.	1	2	3	4	5
2. Physical activity can have a positive effect on my health.	1	2	3	4	5
3. I believe that health problems can be related to eating habits.	1	2	3	4	5
4. I am concerned about the contents of packaged foods.	1	2	3	4	5
5. I am concerned about my child's eating habits.	1	2	3	4	5
6. I am concerned about the growing problem of obesity in the U.S.	1	2	3	4	5
7. I am concerned about the amount of physical activity that my child gets.	1	2	3	4	5
8. I am capable of controlling my weight.	1	2	3	4	5

9. I have control over my children's eating habits.	1	2	3	4	5
10. I have control over the amount of physical activity my children get.	1	2	3	4	5

NUMERO DE CDC: _____

DIRECCION (Cuando se firmó la forma de consentimiento):_____

ENTREVISTADOR(A): _____FECHA: _____

PRE-EXAMEN _____ POST-EXAMEN #1_____ POST-EXAMEN #2_____ (escoja uno y marque con una "X")

CUESTIONARIO DE ACTITUDES SOBRE NUTRICION

- Por favor circule que tan de acuerdo está con lo siguiente:

	Totalmente en desacuerdo	Algo en desacuerdo	Ni de acuerdo ni en desacuerdo	Algo de acuerdo	Totalmente de acuerdo
1. Los hábitos alimenticios afectan mi salud.	1	2	3	4	5
2. La actividad física puede tener un efecto positivo en mi salud.	1	2	3	4	5
3. Yo creo que los problemas de salud pueden estar relacionados con los hábitos alimenticios.	1	2	3	4	5
4. Me preocupa el contenido de la comida empaquetada.	1	2	3	4	5
5. Me preocupan los hábitos alimenticios de mi niño.	1	2	3	4	5

6. Me preocupa el problema de crecimiento de la obesidad en los Estados Unidos.	1	2	3	4	5
7. Me preocupa el tiempo que mi niño dedica a realizar actividad física.	1	2	3	4	5
8. Soy capaz de controlar mi peso.	1	2	3	4	5
9. Tengo control sobre los hábitos alimenticios de mis niños.	1	2	3	4	5
10. Tengo control sobre la actividad física que mis niños realizan.	1	2	3	4	5

CDC NUMBER: _____

ADDRESS (when consent form was signed):

_____

INTERVIEWER: _____DATE:_

_____

PRE-TEST _____ POST-TEST #2_____ (choose one & mark with an "X")

NUTRITION BEHAVIORS SURVEY

When filling out this portion of the survey consider your oldest child who is age 16 or younger.

1. How old is this child?

- ☐ 3 years or less
- ☐ 4-8 years
- ☐ 9-12 years
- ☐ 13-16 years

2. How much water does this child drink in a typical day (a glass is 8 oz. or 1 cup of fluid)?
   - ☐ 9 or more glasses
   - ☐ 8 glasses
   - ☐ 5-7 glasses
   - ☐ 2-4 glasses
   - ☐ 1 glass
   - ☐ None
   - ☐ Don't know

3. How much soda does this child drink in a typical day?
   - ☐ 3 or more glasses
   - ☐ 2 glasses
   - ☐ 1 glass
   - ☐ None
   - ☐ Don't know

4. On average how much physical activity does this child get?
   - ☐ 60 or more minutes per day
   - ☐ At least 30 minutes a day
   - ☐ At least 30 minutes three times a week
   - ☐ Less than 30 minutes twice per week
   - ☐ None
   - ☐ Don't know

5. How much milk does this child drink in a typical day?
   - ☐ 3 or more glasses
   - ☐ 2 glasses
   - ☐ 1 glass
   - ☐ None
   - ☐ Don't know

6. How many servings of fruit and vegetables does this child eat in a typical day? (Examples of a serving are ½ cup of sliced fruit or fruit juice, ¾ cup of frozen vegetables, one small apple, one banana, ten baby carrots, or one ear of corn.)
    - ☐ 5 or more
    - ☐ 4
    - ☐ 3
    - ☐ 2
    - ☐ 1
    - ☐ None
    - ☐ Don't know

When filling out this portion of the survey consider yourself.

7. How much water do you drink in a typical day?
    - ☐ 9 or more glasses
    - ☐ 8 glasses
    - ☐ 5-7 glasses
    - ☐ 2-4 glasses
    - ☐ 1 glass
    - ☐ None
    - ☐ Don't know

8. In the past two weeks have you replaced any beverages with water?
    - ☐ Yes
    - ☐ No
    - ☐ Don't know

9. In the past two weeks have you increased the servings of fruits and vegetables in your meals?
    - ☐ Yes
    - ☐ No
    - ☐ Don't know

10. In the past two weeks have you measured portion sizes?
    - ☐ Yes
    - ☐ No
    - ☐ Don't know

11. In the past two weeks have you counted calories (or points)?
    - ☐ Yes
    - ☐ No
    - ☐ Don't know

12. When do you read nutrition labels? (Check all that apply)
    - ☐ I read nutrition labels for packaged foods
    - ☐ I read nutrition labels to compare calories
    - ☐ I read nutrition labels to compare fat
    - ☐ I read nutrition labels to compare fiber
    - ☐ I read nutrition labels to compare salt
    - ☐ I read nutrition labels to compare vitamins and minerals
    - ☐ I rarely read nutrition labels
    - ☐ I do not read nutrition labels
    - ☐ Don't know

13. On average week how much physical activity do you get?
    - ☐ 60 or more minutes per day
    - ☐ At least 30 minutes a day
    - ☐ At least 30 minutes three times a week
    - ☐ Less than 30 minutes twice per week
    - ☐ None
    - ☐ Don't know

14. What type of milk do you buy for your family to drink? (check all that apply)
    - ☐ Buttermilk
    - ☐ Whole
    - ☐ 2% or reduced fat
    - ☐ 1% or low fat
    - ☐ Skim or fat-free
    - ☐ Non-dairy
    - ☐ Don't know

NUMERO DE CDC: _____

DIRECCION (cuando se firmó la forma de consentimiento)_____

ENTREVISTADOR(A): _____FECHA :_____

PRE-EXAMEN _____ POST-EXAMEN #2_____ (escoja uno y marque con una "X")

CUESTIONARIO SOBRE HABITOS NUTRICIONALES

En esta parte de la encuesta considere a su niño mayor de 16 años o menos.

1. ¿Cuántos años tiene este niño(a)?
   - ☐ 3 años ó menos
   - ☐ 4-8 años
   - ☐ 9-12 años
   - ☐ 13-16 años

2. ¿Cuánta agua bebe este niño(a) en un día normal (un vaso tiene 8 onzas o 1 taza de liquido)?
   - ☐ 9 vasos ó más
   - ☐ 8 vasos
   - ☐ 5-7 vasos
   - ☐ 2-4 vasos
   - ☐ 1 vaso
   - ☐ Ninguno
   - ☐ No sé

3. ¿Cuánta soda bebe este niño(a) en un día normal?
   - ☐ 3 vasos ó más
   - ☐ 2 vasos
   - ☐ 1 vaso
   - ☐ Ninguno
   - ☐ No sé
   - ☐

4. En promedio.¿Cuánta actividad física realiza este niño(a)?
   - ☐ 60 minutos ó más al día
   - ☐ Por lo menos 30 minutos al día
   - ☐ Por lo menos 30 minutos 3 veces a la semana
   - ☐ Menos de 30 minutos 2 veces a la semana

- ☐ Nunca
- ☐ No sé

5. ¿Cuánta leche bebe este niño(a) en un día normal?
   - ☐ 3 vasos ó más
   - ☐ 2 vasos
   - ☐ 1 vaso
   - ☐ Ninguno
   - ☐ No sé

6. ¿Cuántas porciones de frutas y vegetales come este niño(a) en un día normal? (Ejemplos de una porción: ½ taza de fruta rebanada ó jugo de fruta, ¾ de taza de vegetales congelados, una manzana chica, un plátano, 10 trocitos de zanahoria ó un elote)
   - ☐ 5 ó más
   - ☐ 4
   - ☐ 3
   - ☐ 2
   - ☐ 1
   - ☐ Ninguna
   - ☐ No sé

En ésta parte de la encuesta considérese a sí mismo(a).

7. ¿Cuánta agua bebe Ud. en un día típico?
   - ☐ 9 vasos ó más
   - ☐ 8 vasos
   - ☐ 5-7 vasos
   - ☐ 2-4 vasos
   - ☐ 1 vaso
   - ☐ Ninguno
   - ☐ No sé

8. En las últimas 2 semanas. ¿Ha Ud. reemplazado alguna bebida por agua?
   - ☐ Si
   - ☐ No
   - ☐ No sé

9. En las últimas 2 semanas. ¿Ha Ud. aumentado las porciones de frutas y vegetales en sus comidas?
    - ☐ Si
    - ☐ No
    - ☐ No sé

10. En las últimas 2 semanas. ¿Ha Ud. medido sus porciones?
    - ☐ Si
    - ☐ No
    - ☐ No sé

11. En las últimas 2 semanas. ¿Ha Ud. contado calorías (ó puntos)?
    - ☐ Si
    - ☐ No
    - ☐ No sé

12. ¿Cuándo lee Ud. las etiquetas de nutrición? (Marque todas las que aplican)
    - ☐ Yo leo las etiquetas de nutrición de la comida empaquetada.
    - ☐ Yo leo las etiquetas de nutrición para comparar calorías.
    - ☐ Yo leo las etiquetas de nutrición para comparar grasas.
    - ☐ Yo leo las etiquetas de nutrición para comparar la fibra.
    - ☐ Yo leo las etiquetas de nutrición para comparar la sal.
    - ☐ Yo leo las etiquetas de nutrición para comparar vitaminas y minerales.
    - ☐ Raramente leo las etiquetas de nutrición.
    - ☐ No leo las etiquetas de nutrición.
    - ☐ No sé

13. En una semana promedio, ¿cuánta actividad física realiza Ud.?
    - ☐ 60 minutos ó más al día
    - ☐ Por lo menos 30 minutos al día
    - ☐ Por lo menos 30 minutos 3 veces a la semana
    - ☐ Menos de 30 minutos 2 veces a la semana
    - ☐ Nunca
    - ☐ No sé

14. ¿Qué clase de leche compra para Ud. y su familia? (marque todas las que aplican)
    - ☐ La nata de la leche
    - ☐ Entera

- ☐ 2% ó reducida en grasa
- ☐ 1% ó baja en grasa
- ☐ Descremada ó sin grasa
- ☐ No lácteos
- ☐ No sé